The Christmas Of The Computer

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The Leading Magazine Of Home, Educational, And Recreational Computing

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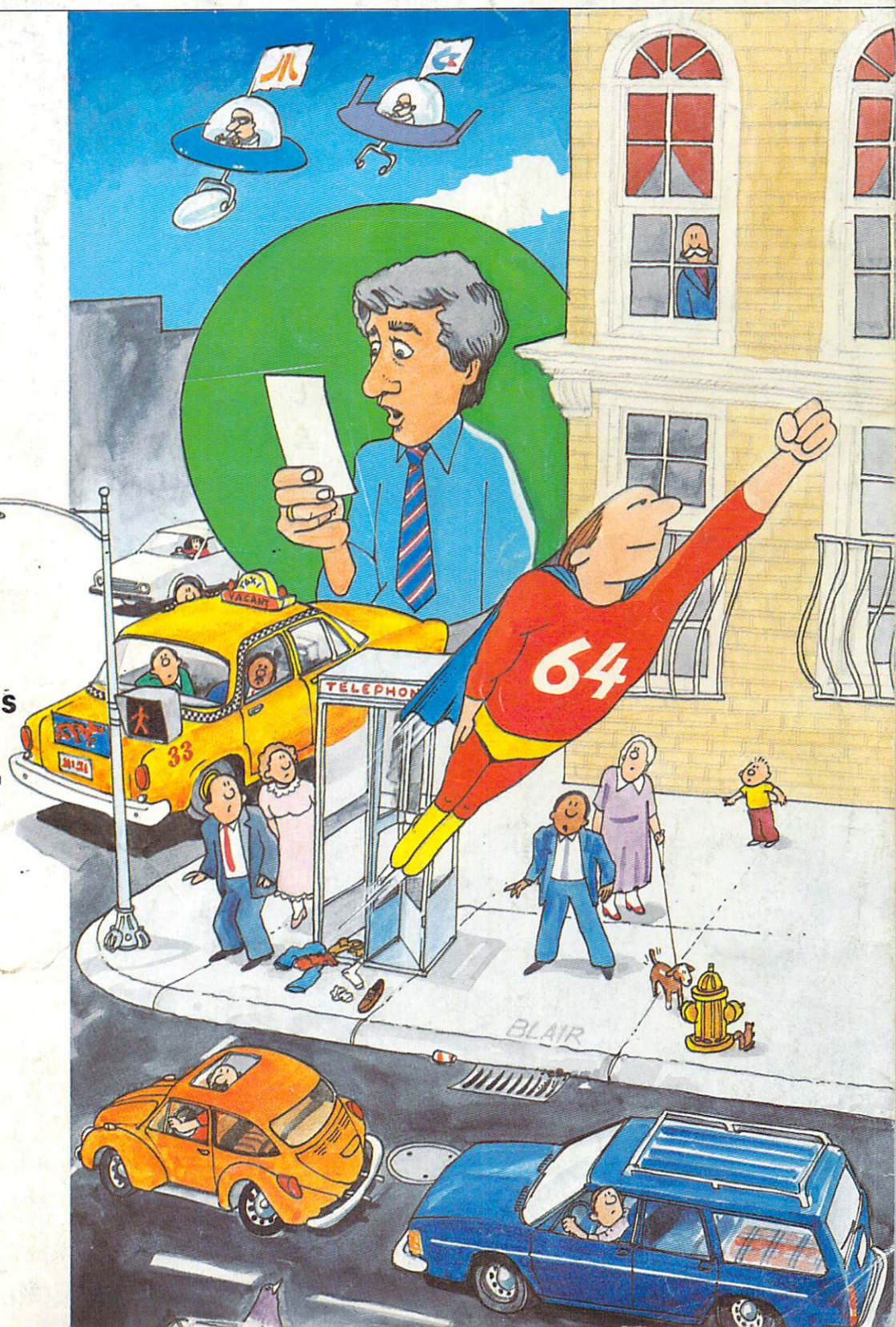

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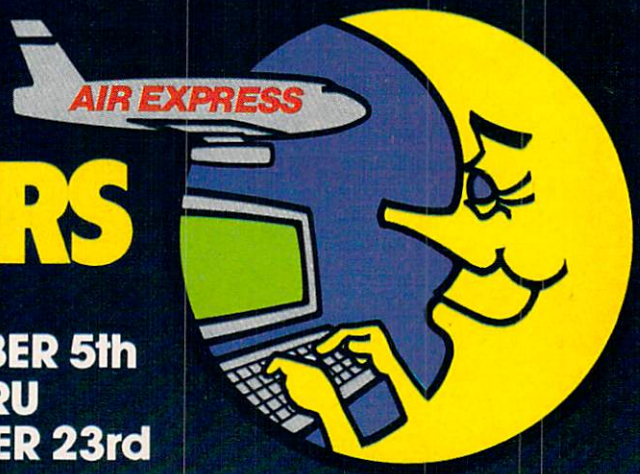

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EDITOR'S NOTES

If all the rumors are correct, by the time you're reading this, IBM will have announced and introduced "PC Junior," the new personal and home computer also known as "Peanut." If you own a PC, a "Junior," or a Coleco Adam system, we're interested in articles. Address them to Submissions Editor, New Computers, COMPUTE!, P.O. Box 5406, Greensboro, NC 27403.

While this Christmas was destined to be "the Christmas of the computer," delays in shipments for Coleco and Atari, and the impact of expectations regarding the new IBM entry, have made it anything but a happy season for investors in the personal computer stocks. Texas Instruments, Commodore, Warner Communications (Atari), and Coleco have been seesawing back and forth with every delay, anticipated or actual. Warner stoutly denies any falling off in their intentions toward the personal computer marketplace; Coleco vows to ship hundreds of thousands of systems by Christmas; and Commodore head Jack Tremiel is quoted in the *Wall Street Journal*, in response to concerns about IBM's pending entry, as suggesting that there are far more people with $200 than $700 for a computer. We should doubtless look forward to an interesting spring.

From COMPUTE!'s perspective, we're seeing thousands of new computers sold every week, and plan to continue providing you the same level and quality of applications and support. We *don't* expect the major players to change anytime soon.

We noted with regret the filing of bankruptcy by the Osborne Computer Corporation, and with special regret some of the mudslinging that occurred after the fact. Among the available scenarios is the possibility that Mr. Jaunich, president of the company, arrived too late to stem the flood of problems that predated him. Our regrets to the laid-off employees, and best wishes for a sound recovery.

If you're in the marketplace for a unique Christmas present, Kathy Yakal presents a random sampling in the sidebar to her feature "The Christmas Of The Computer?" A chocolate diskette, perhaps?

Random Bits:

This is the largest issue ever of COMPUTE! and all of our previous records are being broken: largest number of pages, largest number of four-color advertising pages, largest number of advertising pages, *and* largest number of editorial pages.

Our compliments to Senior Editor Richard Mansfield. His book, *Machine Language for Beginners*, was recently ranked among the top five best-selling computer books in the country.

COMPUTE! is moving. Each year, in the five-year-long history of our company, we've moved into new quarters that we were convinced would last us several years. Our fifth move is coming up in late January, and this time we're *really* going to move into a location that will hold us for several years. We've not only left room for next year's new staff members, but have planned expansion space for future years' growth. None of the old-timers around here are quite sure what it will be like to stay in one spot for more than twelve months, but we're certainly looking forward to it. Next month we'll let you know the address of our new location. The post office box and telephone numbers will remain the same.

The staff of COMPUTE! Publications, Inc., wishes you all a happy holiday season and a safe and rewarding new year.

Editor In Chief

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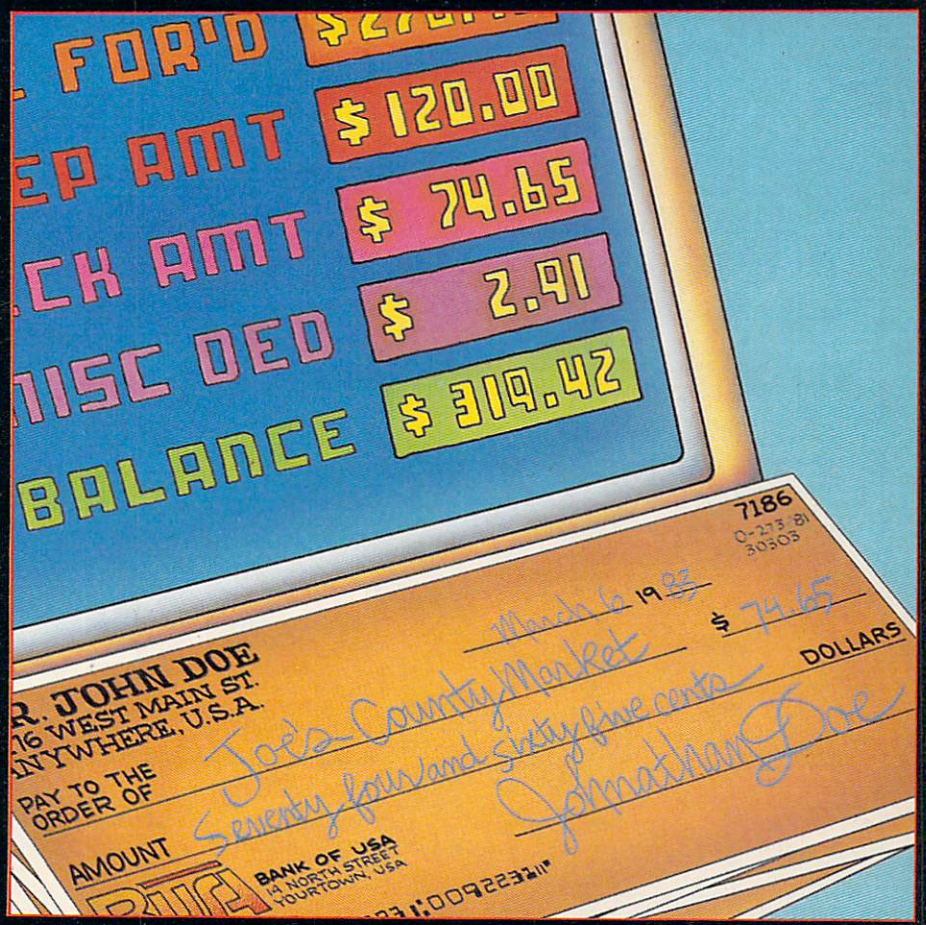

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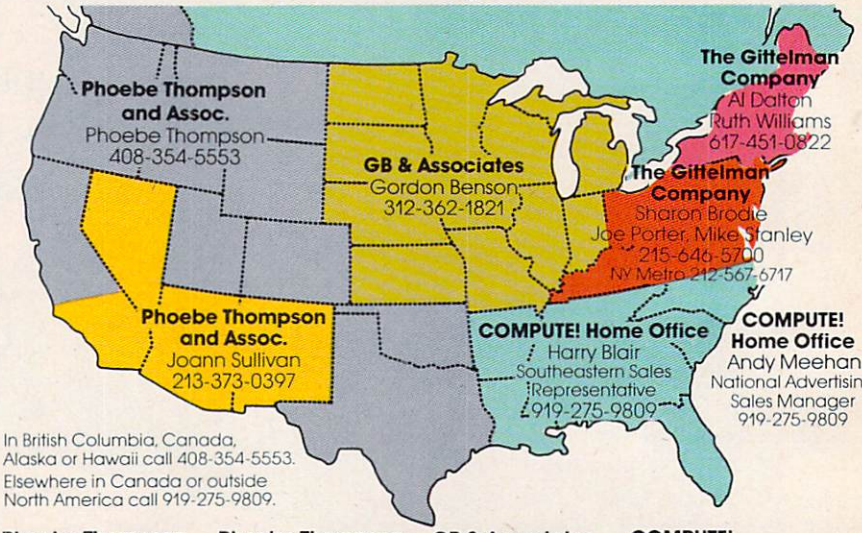

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READERS' FEEDBACK

The Editors and Readers of COMPUTE!

Chill Factor For Disks And Tapes

I have often read that diskettes must not be exposed to temperatures below 50 degrees. Does this mean that people who live in cold climates must not order disks or programs by mail in the winter? Will the disk be ruined or must it be given time to warm up again? Do cassettes suffer the same limitations?

Helen Weidner

Severely cold weather should not limit your mail order purchases of diskettes (blank or preprogrammed). The storage medium will keep some of the cold away from the disk. However, the safest procedure is to climatize *the disk for at least 24 hours before inserting it in the drive. Extreme cold and heat cause contraction and expansion of the plastic disk, which alter the disk track locations.*

Also, extreme humidity can damage a disk. A safe guideline (suggested by 3M, for disk operation) is a temperature range of 50 to 125° Fahrenheit and 8 to 80% humidity. Cassette tapes are less sensitive than disks to temperature and humidity extremes, but climatizing them, too, is a good idea.

Where Are The Commodore 1541s?

We have received many letters from readers asking about the disappearance of Commodore 1541 Disk Drives from the market. A Commodore representative told us that the demand was greater than the supply. Apparently, Commodore did not anticipate that so many 64 owners would purchase 1541s rather than Datassettes.

However, several Commodore dealers informed us that the return rate of 1541s had recently been high, suggesting a technical flaw. Possibly Commodore is attempting to locate and correct the problem and then reissue the 1541s. Commodore has said that the drives would be back on the market soon.

Reading Commodore 1541 Disk Drive Memory

I own a 1541 Disk Drive. I wrote a small program so I could read the disk ROM and display the contents in hex format. Starting at location 00, I can get information for about 100 bytes. Then I get a repeating pattern: 0D,30,30,2C,20,4F,4B,2C, 30,30,2C,30,30,0D. Other than location 00, no matter where I start, I get this same pattern.

Can you help me?

Larry Rieth

Jim Butterfield replies:

It's not hard to view disk ROM, once you get the commands right. The false pattern you were getting, by the way, is the 00,OK, 00,00 status message in ASCII. I find it easiest to call up the bytes one at a time.

The program here should do the job. There are some "cursor cosmetics" built in to aid with convenience of use; these are not essential, so you may want to eliminate them. Everything is in hexadecimal, since that's the most convenient way to read machine language. Again, change this if you wish.

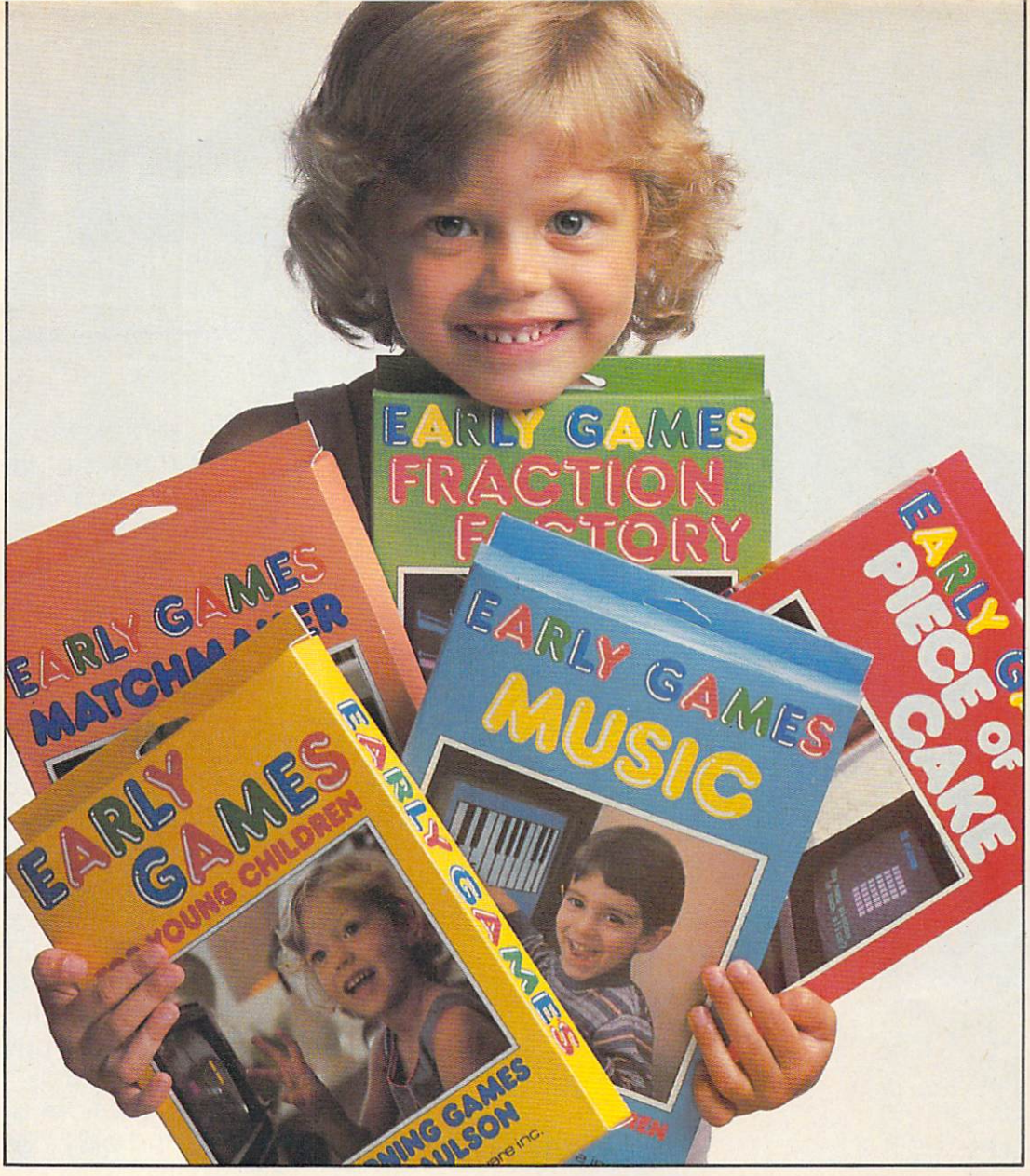
I don't have any 1541 memory maps. I have been hanging back since Commodore has been known to change architecture from time to time. If you want to view disk ROM, start at $C000 and work up from there.

```
190 PRINT"INPUT MEMORY ADDRESS"
200 PRINT"IN HEXADECIMAL:":OPEN1,8,15
220 PRINT"{2 SPACES}{4 RIGHT}{31 SPACES}
    {UP}"
230 Z$="XXXX":INPUTZ$
240 PRINT"{UP}";:IF LEN(Z$)<>4 THEN GOTO
    {SPACE}220
250 T=0:FOR J=1 TO 4:Y=ASC(MID$(Z$,J))
260 Y=Y+48*(Y<58)+55*(Y>64)
280 IF Y<0 OR Y>15 THEN GOTO 470
290 T=T*16+Y:NEXT J:K=0:PRINT"{6 RIGHT}";
300 V=INT(T/256):U=T-V*256
360 PRINT#1,"M-R";CHR$(U);CHR$(V)
370 GET#1,X$:IF X$="" THEN X$=CHR$(0)
380 PRINT" ";:X=ASC(X$)/16
390 FOR J=1 TO 2:GOSUB 500:NEXT J
420 T=T+1:K=K+1:IF K<8 GOTO 300
440 X=T/4096
450 PRINT:PRINT"{2 SPACES}";:FORJ=1 TO 4:
    GOSUB 500:NEXT J:PRINT"{UP}":GOTO 220
470 CLOSE 1:END
500 X%=X:X=(X-X%)*16:IF X%>9 THEN X%=X%+7
510 PRINT CHR$(X%+48);:RETURN
```

Atari XL Features, Disk Density, And Octave Expansion

Upon reading your review of the Summer Consumer Electronics Show (August 1983), I thought of the following questions about Atari's computers:

1. Do the XL series require a plug-in BASIC car-



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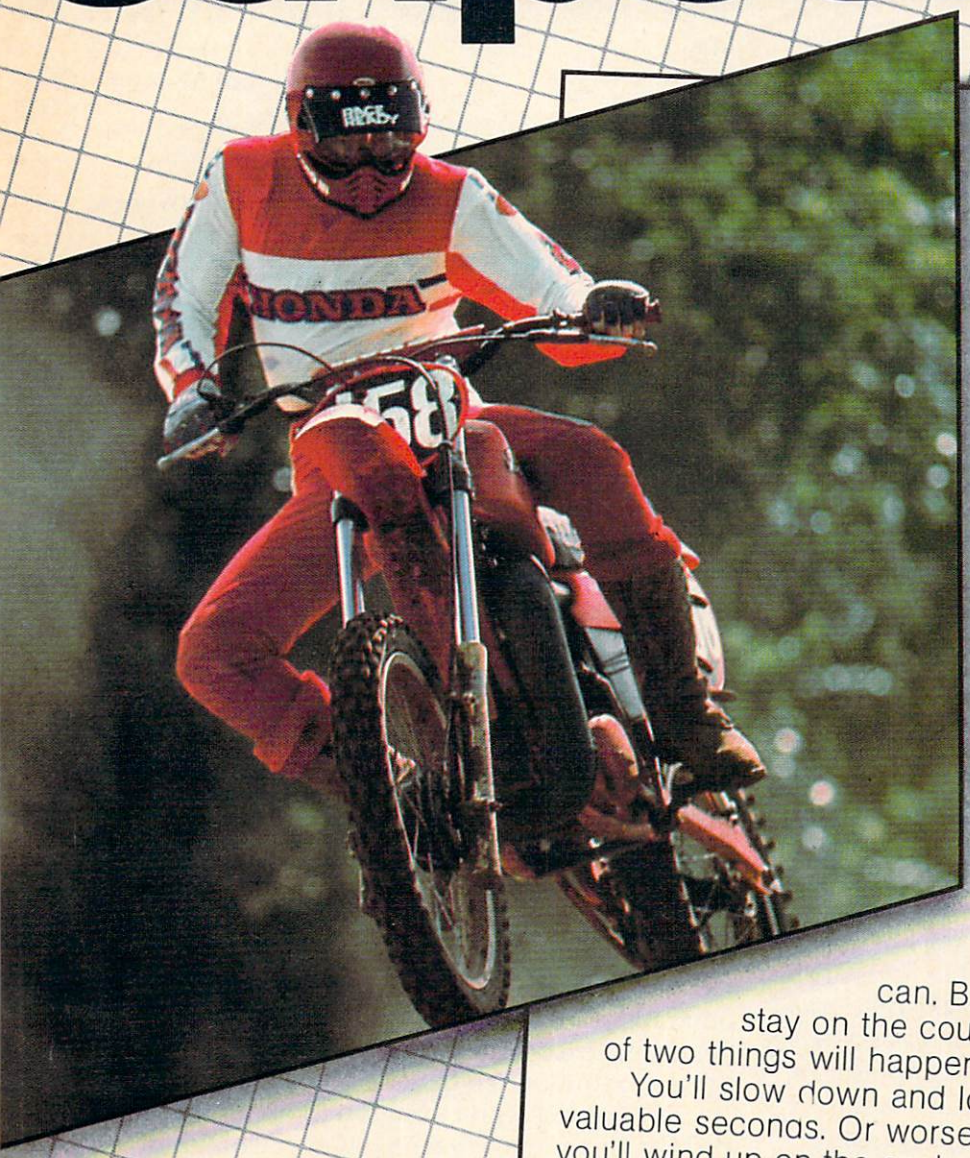

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tridge, or is BASIC built-in?

2. What is the physical difference between a single-density disk and a double-density disk?

3. How can a single-density disk be converted to double-density?

4. Are there any software or hardware packages available to increase the amount of music octaves the Atari computers can generate?

5. How does the direct-connect modem included in the 1400XL and 1450XLD computers work (as far as connection goes)?

Andrew Matsuoka

1. *The 1200XL requires the optional BASIC cartridge, but the new 600XL, 800XL, 1400XL, and 1450XLD all have BASIC built-in.*

2. *The term* double density *can be loosely applied. It can refer to more tracks per inch (TPI), larger sector size (128 bytes versus 256), or additional tracks and sectors. In an effort to provide compatibility, Atari does not truly use double density. In effect, they added extra sectors, increasing disk storage from 90K to 127K.*

3. *The 1050 drive can read single-density disks, so it is a simple matter of copying a file from a single-density disk to a formatted double-density disk.*

4. *The four Atari sound generators have an eight-bit resolution, so there are only 256 possible notes, or five and a half octaves. It is possible to chain two voices together to create one voice with 16-bit resolution, permitting a nine-octave range. You can have two 16-bit voices, or one 16-bit voice and two eight-bit voices. The* Advanced Music System, *available from APX (Atari Program Exchange) allows 8-bit sound and can be synchronized with an external cassette recorder to let you create recorded music with more than four voices. (You play one tape through the speaker while the Atari plays music. The composite sound is then recorded on a second tape recorder.) Take a look at "16-Bit Atari Music" in the March 1983 issue of* COMPUTE!.

5. *Direct-connect modems attach to telephones with modular jacks, either through the handset or the base. If you cannot simply unplug the cords from your telephone, you'll need to contact your telephone company. Adapters are also available from stores like Radio Shack.*

Dual Joystick Control On The TI-99/4A

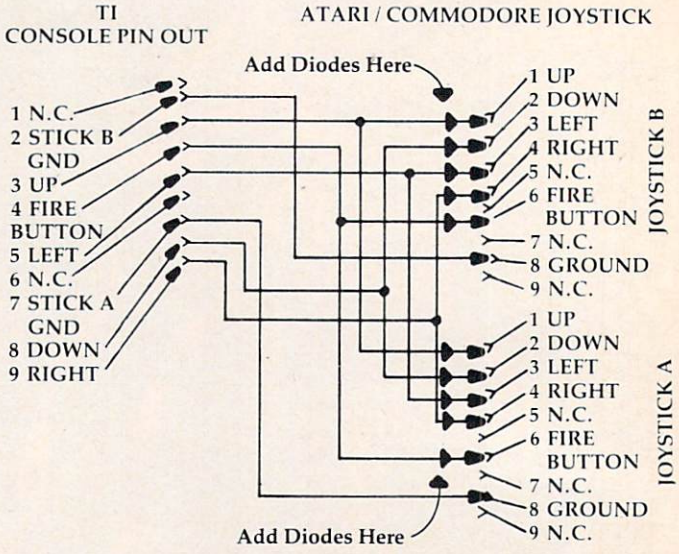
I built the adapter suggested by Gary Cook ("How To Build Your Own TI-99/4A Joystick Adapter," COMPUTE!, August 1983), and it worked well as long as I only used one joystick. However, when I tried two joysticks in a program, I discovered that the joysticks would lock each other up when moved in the same direction until one of the joysticks was disabled.

To correct this, I added diodes (1N914 or equivalent) at each connection except ground. Diodes should be added in the lines going to both joysticks, and they should have the cathode (banded end) toward the joystick switches. After this modification, simultaneous joystick movement was fine.

Enclosed is a modified drawing of the adapter box.

Jim Mallonee

We tested this and it works well. This alteration is unnecessary for those who plan to use only one joystick.



POKE Dangers

I'm concerned about the admonitions from the *Commodore 64 Programmer's Reference Guide.* On page 215: "...without an assembler you will have to POKE the machine language program into memory which is totally inadvisable." Even more ominous is the note on page 417: "Commodore Semiconductor Group cannot assume liability for the use of undefined opcodes."

What's the worst thing a wrong number could do? Erase magnetic files? System crash? Could an undefined opcode cause permanent hardware damage?

David Paulsen

Feel free to POKE around anywhere in your computer without worrying about causing trouble. The two warnings that you quote refer to two different things.

It would be "inadvisable" to POKE a machine language program into the computer without using an assembler because it would prove extraordinarily frustrating. Creating a machine language program by POKEing in the codes wouldn't disturb your computer, but it would take so long and would be so error prone that it might well drive you up the wall.

The other issue is rather technical. The 6502 chip, the little "brain" within Commodore and other computers, has a theoretical capacity to understand 256 different commands (opcodes) in machine language.

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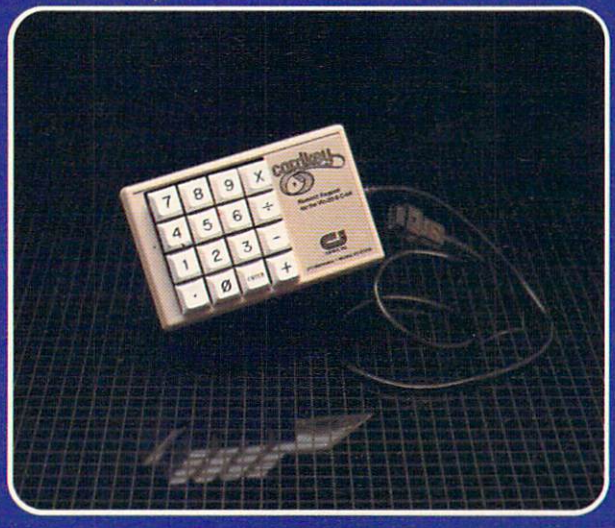

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However, the designers only created 56 commands which, even when multiplied by their several addressing modes, still don't use up all 256 possible opcodes. However, some of these unassigned numbers will nevertheless have effects if you use them in your ML programming. For a complete description of these hidden commands, see "Extra Instructions," an article in the October 1983 issue of COMPUTE!.

How Much Memory For An Atari Disk?

I'm very seriously thinking about purchasing a disk drive for my Atari 400. I want to know if 32K is enough memory to have a disk drive and run DOS, and still program. Is the *new* Atari disk drive able to plug right into your computer?

Adam Bullock

As a matter of fact, it's possible to run a disk drive with a 16K Atari. DOS (without the menu) uses under 6K. For practical purposes, though, you should have at least 24K in order to run most programs.

The new 1050 double-density (256K) drive attaches to the standard serial port like any other Atari peripheral.

Commodore 64 Video Revisited

An Update From Jim Butterfield

The programs given in "Commodore 64 Video – A Guided Tour," Parts 6 and 7 (July and August, 1983), work fine on my machine, and will work well on many earlier model Commodore 64 machines. On the newer machines, there's a problem that can be solved by adding the extra line:

```
90 POKE 53265,27
```

Here's the problem: In newer models of the 64, the computer actually does its own raster interrupt at time of power-up. This is done for a peculiar reason: The computer wants to know if it's a European model or not.

As TV technicians will tell you, North American television has 525 scan lines, whereas the European PAL system has well over 600. The computer's internal clock also runs at a slightly different speed. But the ROM is the same in both systems.

Now, the ROM needs to know whether it's working within a European or North American system, since it will want to time certain events (realtime clock, communications speeds, cassette tape) at a constant speed regardless of its internal clock rate. So at time of power-up, it commands: "Tell me when I reach line 622 of the screen." (The actual value it uses is 311, since scan lines are "twinned.")

Some time later, the computer asks, "Has line 622 showed up?" If the answer is yes, the computer knows it must be on a European system. If the answer is no, the computer decides that this must be the North American system, which doesn't have 622 lines on the screen. Now the computer can fix up its timing tables.

In the meantime, it has left the raster register with a high number in place. To make the split programs in Parts 6 and 7 work, we must take this high number out. Address 53266 handles most of the raster register, and it's all we need to do the job specified. But first we must clean out that high bit in address 53265 with a POKE value of 27.

If this seems rather complex, don't worry about it. Just add the line 90 POKE 53265,27 to all programs, and everything should behave correctly.

A Sharper Picture For The TI-99

The normal screen color of the TI-99/4A — assuming you have a color TV — is green while the program is running and blue when it is not. If you have a black-and-white TV, you can get a sharper picture by asking for a gray background with a statement like

```
10 CALL SCREEN(15)
```

at the beginning of the program. This disables the color-generating circuit of the TI-99 and removes the pattern of vertical lines often seen on a black-and-white TV that is fine-tuned for maximum sharpness. It also increases the sharpness of the characters. The change remains in effect as long as the program is running.

The same idea can be applied to other machines that allow you to control the background color.

Michael A. Covington

Atari 800 Software For The 1400XL/1450XLD

I was thinking of trading my Atari 800 for the 1400XL or the 1450XLD, but would all the software for the 800 work in the 1400XL and/or in the 1450XLD? Or, would it be easier to just buy the CP/M module and the Atari expansion box for my 800?

I am looking for a disk drive for my Atari 800. I have seen the Atari 810 and the 1050, the RANA 1000, and the Percom disk drives. Which one would be the least expensive and still be a good choice?

Also, I would like to know if the Commodore 1701 Video Monitor would hook up to my Atari 800 through the monitor jack.

Shane McWilliams

Almost all BASIC programs and the majority of other programs will run just fine on the new XL computers. The Atari Operating System in ROM was designed so that future upgrades would be transparent to previous software, as long as that software followed certain rules. Some programs shortcut these rules, so they end up ac-

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cessing routines that have moved elsewhere in the new XL computers. Atari has published a list of Atari programs that do not work properly on the new machines.

If you are only interested in CP/M, you do not need an XL computer (the CP/M module attaches via the serial port), but many future expansion cards will not work with non-XL Ataris (or the 1200XL).

All the third-party disk drive manufacturers offer certain features over the 810 disk drive, most noticeably price. The new so-called double-density Atari 1050 drive reduces the price gap, but some third-party drives offer twice the 90K storage of the 810, along with dual drives, LED consoles, and printer ports. As with computers, the decision is up to you.

Look at the drives critically and decide what features you want and need. You should make sure the drive offers total compatibility with Atari drives, so you can boot, read, and write disks prepared on an 810, such as commercial programs or a friend's disk. Most third-party drives deviate slightly from the 810 drives, but so do individual 810's from each other. Borrow several copies of disks prepared with an 810 and try them out on the unit in question. Warranties and service options are also crucial with this type of equipment. You cannot count on your authorized Atari service center to repair a third-party drive.

And, yes, you can use the Commodore 1701 Video Monitor with your Atari. As a matter of fact, you can even use the proprietary video enhancement circuit via the rear connections of the monitor. Just buy or wire a cable to correspond to the RCA jacks and the Atari monitor pinout (the Commodore 64 and the Atari monitor jacks are almost identical). You can also connect your Atari and 1701 with the cable that comes with the monitor. The monitor can also be used via the front connections with any computer that has composite video output, such as the TI-99/4A.

Modifying The Kernal On The Commodore 64

I have been trying to run the Kernal from RAM – the same RAM underneath the Kernal ROM from E000 to FFFF. I'm trying to make some modifications to the Kernal, but as a first step it would be best to move the unmodified Kernal from RAM. I've come close to being successful, but just when I think it's ready to work, the computer crashes. Do you have a solution?

Charles Kluepfel

A strange thing happens when you try to flip out the Kernal – the BASIC ROM goes, too. It might be helpful to read "Commodore 64 Architecture" (COMPUTE!, January 1983).

If you want to rewrite the Kernal routines, you must also copy BASIC into RAM. In BASIC, the whole procedure would be:

```
FOR J=40960 TO 49151:POKE J,PEEK(J):NEXT
  {SPACE}J (COPY BASIC)
FOR J=57344 TO 65535:POKE J,PEEK(J):NEXT
  {SPACE}J (COPY KERNAL)
POKE 1,53 (SWITCH OUT BASIC AND KERNAL RO
  MS)
```

This is the piece you're missing. Now it will work.

Avoiding TI INT

A little known fact about TI computers is that they will accept nonintegers for arguments such as array subscripts and CALL HCHAR and CALL VCHAR arguments. If a floating point value is used, the computer will round off to the nearest integer. For example, A (1.6) is the same as A (2), and A(5.25) is the same as A (5).

This is useful when you want to compute the proper element of an array with floating point values. For example, say you have a sprite with coordinates SPRITEX and SPRITEY, and you want to see what's underneath it on the screen. You can then use the following command to get the value:

```
CALL GCHAR(SPRITEY/8+.5,SPRITEX/8+.5,var)
```

Why is this important? Taking the INT of those values uses a lot of valuable time, and the INT is absolutely unnecessary. In a graphics program, this can speed things up considerably.

Neil Weinstock

Cassette Auto-Boot For Atari "Roadblock"

If you have a working copy of "Roadblock" (COMPUTE!, July 1983, page 108), make the following changes to create a cassette boot version.

1. Load the *original* listing of Roadblock. This must be a working copy.

2. Change line 10 to:

```
10 OPEN #3,8,128,"C:":FOR I=13804 TO 15010:
  READ A:PUT #3,A:NEXT I:CLOSE #3:END
```

3. Delete line 15.

4. Add line 1000 as follows:

```
1000 DATA 0,10,236,53,242,53,169,60,141,2,211,169,
  196,133,10,169,57,133,11,96
```

5. LIST or SAVE to tape.

6. Ready the cassette on which you want your boot version, and make a note of the tape counter.

7. Now RUN the modified program (which is still in memory).

8. You will hear two beeps. Press play and record on tape and then any key on your computer and a cassette boot will be created.

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9. Rewind the tape to the count you noted earlier. Turn off your computer and remove the BASIC cartridge. Turn on your Atari while holding down the START button.

10. You will hear one beep. Press play on tape and then any key on your computer and Roadblock will auto-boot.

The cassette boot that you have just created should load and run in approximately 65 seconds. For an even faster cassette boot (45 seconds), use Ed Stewart's program in *COMPUTE!'s Second Book Of Atari*, page 227.

Richard K. Wagner

DEF FN In Atari BASIC?

The statement DEF FN does not work in Atari BASIC. How can I convert DEF and FN statements to work on my Atari?

Sam Scarfina

First you need to define what an "alien" BASIC's commands do in order to translate them. The purpose of DEF is to define a user-written function. Functions intrinsic to Atari BASIC include COS, INT, SQR, FRE, etc. DEF FN would let you create your own function. For example, DEF FND2(V) = V/2 is a function that divides a number by two. PRINT FND2(10) then would give you a five, and FND2(3) gives 1.5. The variable V, called a dummy variable, defines the relationship of the number you give the function. You can still use V in your program (and you don't have to use V as the dummy argument) as its value won't be changed by a FN statement.

On the Atari, you can just write a subroutine to accomplish the same thing. For example:

```
1000 X=X/2:RETURN
```

Just set X equal to the value in the function's parentheses, GOSUB 1000, and assign X appropriately. You can even name the subroutine with DIV2=1000 and then GOSUB DIV2.

COMPUTE! welcomes questions, comments, or solutions to issues raised in this column. Write to: Readers' Feedback, COMPUTE! Magazine, P.O. Box 5406, Greensboro, NC 27403. COMPUTE! reserves the right to edit or abridge published letters. ©

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The Home Office

Kathy Yakal, Editorial Assistant

Computers have been used in businesses for many years to streamline procedures, promote efficiency—even to do things that were never possible without them. The same thing is beginning to happen in homes with microcomputers: New businesses are being created, and existing home offices can benefit from the variety of information services and software that is available. This article explores some of the ways that the traditional office is changing.

Sue Click, of Cardio-Trace of Indiana, demonstrates how a person's heartbeat can be transmitted from a pacemaker to an electrocardiogram machine through a modem.

For some people, "going to the office" no longer means a hurried breakfast, a quick glance at the newspaper, and a frenzied trek through rush-hour traffic. There are many options now available for people who would like to be able to do at least some of their work at home with a personal computer.

Working at home is not a new concept. There are many jobs that can be done easily in a home atmosphere: free-lance writing, day care, mailing services, some types of accounting, and so forth.

But the availability of microcomputers, and the proliferation of small business software and telephone linkups to huge banks of current news and other information, have made it possible to locate many offices wherever the worker wants them.

You don't need an expensive, multifeatured business computer to run a business from your home. It's not necessary to have a technical background. And you won't find a catalog limiting you to a certain selection of jobs.

"The limit to what you can do with a personal computer to start a business is human imagination," says Hank Scheinberg, an executive vice president for Continental Software in Los Angeles. "I don't think it's necessary to have a higher-level machine to do it, either. The lower-end machines will continue to get easier to use."

Selling Words

According to many software distributors, business software is starting to outsell games. Accounting and mailing list programs are very popular, but perhaps the best sellers are word processing software.

It appears that many of those people who are purchasing word processors are using them for business purposes. "I would say that that's the most common use among my readers," says J. Norman Goode, publisher of *Micro Moonlighter Newsletter*. "And it's not just the general concept of word processing. There are many variations that people don't often think of, like supplying vendors with reader service information."

Goode's newsletter is geared toward people who want to use their microcomputers to earn some portion of their income. "I would say that the majority of our readers are moonlighters, people who need a second income or who want to set their spouses up in some sort of home business," says Goode. "But I occasionally get letters from people who were successful enough to turn their part-time jobs into full-time ones."

The second most popular home business, according to Goode, is the consulting service. "The hottest topic is information brokering," he says. "For a fee, people will do specialized research by accessing on-line data bases, which they then write up as a report for their client."

An Unusual Application

Computers are becoming an important part of even the most personal of services, like health care. Medical procedures and equipment have made great advances by using microprocessors. But some people fear this, thinking that medical attention could become cold and impersonal.

Sherry Pegg and Sue Click, of Indianapolis,

Introducing a computer game that will bring out the railroad buff, the tycoon, the adventurer, and the kid in your kid.

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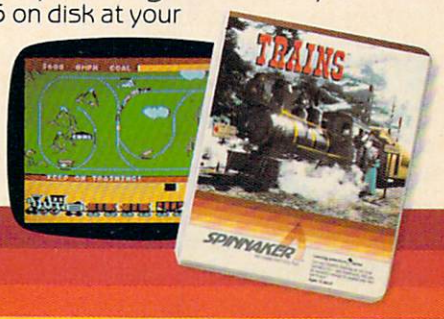

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Indiana, operate a health-related business out of Pegg's home that is convenient and comfortable for patients, and far from impersonal.

Called Cardio-Trace of Indiana, the company was set up eight years ago to provide follow-up care for people who have recently had pacemakers installed. Pegg and Click visit the homes of cardiac patients, get to know them and explain procedures, and give them a small transmitter about the size of a cigarette case. If the patient prefers, he or she may wear the transmitter in a ring or bracelet.

The transmitters, which are designed by the individual pacemaker manufacturer, are actually tiny modems. They differ from the modems commonly used with personal computers in that they send only analog messages and can only transmit, not receive, signals.

When Pegg and Click call, the patient puts the transmitter next to the mouthpiece of the phone; a signal is then sent over the phone lines. That signal translates into a readout on an electrocardiogram machine. Pegg and Click, who have been trained to read those traces, can tell if the patient is experiencing any unusual heart rhythms and if the transmitter is still functioning properly.

Of course, if the readout indicates some serious problem, the patient's physician is called immediately. If not, they send the readout to a cardiologist for analysis, and a written report to the patient's doctor.

The office paperwork is done on an Apple II+ using software modified by Pegg's husband, Terry, who is a biomedical engineer at St. Francis Hospital in Indianapolis. Terry's program allows them to send form letters, maintain detailed patient files, and keep general business files like accounts receivable and tax records.

Keeping Up At Home

A personal computer and a modem give you access to a spate of news and information services. Even if you don't have a home business, these electronic clearinghouses may still provide you with information that will enhance your work, your financial affairs, or your personal life.

Subscriptions are required to access most of these services. Some charge a per-minute fee for on-line time; in many cases, though, you are supplied with a toll-free or local number to avoid running up huge long-distance charges.

CompuServe and The Source are probably the best known, but there are some new and some more specialized teleservices.

• Desk Top Broker

This financial service, which has recently come on-line, allows you to enter transactions, maintain a portfolio, and see current stock prices on your home computer 24 hours a day, 7 days a week.

"For the first time, individual investors can service their own accounts as fast as any broker. The Desk Top Broker provides unprecedented independence and fiscal agility, giving the little guy an edge in the market," says C. Derek Anderson, president of the brokerage firm C.D. Anderson & Co. "It marks a new era in personal investing."

• RCA Hotline

RCA Global Communications, which has operated a Telex service for a number of years, has recently introduced a system for home computer owners. Called the RCA Hotline, it offers world news, sports, weather, international financial information, and even things like book, movie, and record reviews.

Alan Garratt, administrator for public affairs at RCA, sees a number of business applications for Hotline subscribers, especially those involved in worldwide business transactions. "Executives find that they can make good use of it at work or at home," he says. "If you get a great idea at 11:00 at night, you can write it up and send it off, whether or not anyone is in the office."

Free-lance writers who write for overseas publications, communications consultants, and people involved in importing and exporting manufactured goods have also found the service useful, according to Garratt.

"It's not so much that our system makes possible jobs that couldn't be done before," he says. "They can just do it much easier—productivity time is better."

More To Come

These examples are not given to imply that we are moving toward an entire work force that operates from its members' homes. Some types of businesses may always require a staff to work together at one location. But microcomputers, business software, and the instant information and communication made accessible through telecommunications, are generating new options for business sites.

For more information, contact:

Micro Moonlighter Newsletter
4121 Buckthorn Ct.
Lewisville, TX 75028

RCA Global Communications (Hotline)
60 Broad St.
New York, NY 10004
attn: Alan Garratt
Customer Service: (800)526-3969

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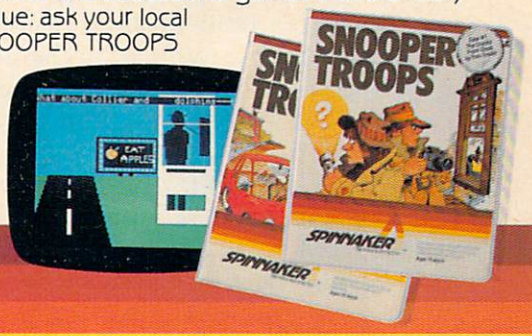
SNOOPER TROOPS detective games help your children learn to take notes, draw maps, organize and classify information and they help develop vocabulary and reasoning skills. All while your kids are having a good time.

So if you want to find educational games that are really fun, here's a clue: ask your local retailer for SNOOPER TROOPS computer games.*

*Available in disks for IBM,® Atari,® Apple,® Commodore 64.™



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David D. Thornburg, Associate Editor

High Tech, High Touch, And 1984

Take a deep breath everybody — 1984 is a month away.

It is obvious to everyone who cares to look that 1984 is going to be a pretty good year. In fact, it will be nothing like the deeply depressing vision of George Orwell in his novel.

It is interesting to examine why 1984 won't happen the way Orwell said it would. In fact, the reason is pretty simple — at the same time we've been moving into a high-tech world, we've also been growing in our sensitivities as human beings. In the book *Megatrends*, John Naisbitt points out that the growth of the human potential movement has run parallel to the growth of high technology in the marketplace.

This is fortuitous, since we are at one of those points in history where major social change is possible.

For the last several years we have been making a transition from an industrial economy to an information economy. To put it simply, American car production has dropped through the floor while computer and software production has shot through the roof. From a time when most of our countrymen worked in the fields, we have moved to an era where only 3 percent of our work force produces our food, and more than half of us work in the information sector.

Orwell's vision for 1984 predicted the tremendous growth in the number of information workers, but it also depicted this transition causing us to become faceless entities to be manipulated by the government. Reality has been far kinder simply because of our own sensitivities as human beings. Perhaps it is our genetic survival coding that insured that we would not roboticize ourselves.

Perhaps, it was just luck.

For whatever reason, we gave ourselves the chance to retain our humaneness, and we took it. Do you remember the three big movies in the summer of 1982? Two were high tech (*TRON* and *Star Trek II*), and one was high touch (*E.T.*). You know which one was popular.

Did you see *On Golden Pond* or *La Traviata* — and cry?

I did.

The popularity of films that touch us is one sure sign that we are not about to sacrifice our human spirit on the altar of high technology. But what really delights me about our new age is that the computer — the supreme embodiment of high technology — can and will be seen as a tool to enhance and preserve our creative spirit. The computer can be a tool to bring us together, not pull us apart.

Of all the places where the computer has this power, I think the schools are among the most important. To see just one example of why this is so, consider the use of word processors in the classroom.

One of the greatest forces that stifle creative writing is the labor of recopying a final manuscript. I've seen many third- and fourth-graders learn to hate story writing because of the laborious hand copying involved with the creation of a legible manuscript. A word processor goes a long way towards solving this problem.

Of course, some teachers (failing to realize that we already have) may argue that we shouldn't make our children dependent on high technology. Very few children know how to make a quill pen, or how to make their own inks. In fact, many children have access to very high tech ball-point pens, some of which use tungsten carbide balls (tungsten carbide is very high tech).

The issue of accessibility to word processors will go away as the computer continues to become more commonplace in homes and schools. The

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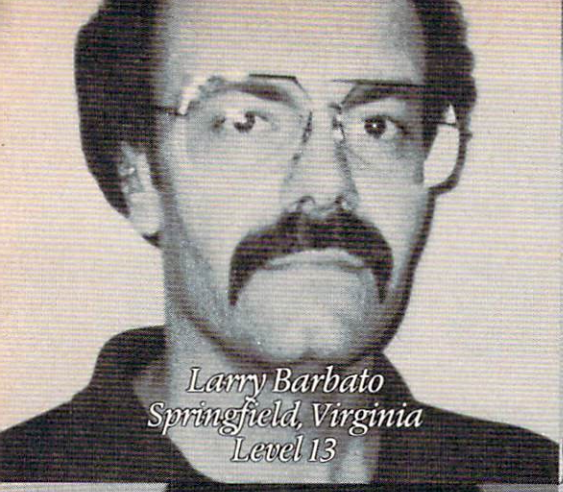
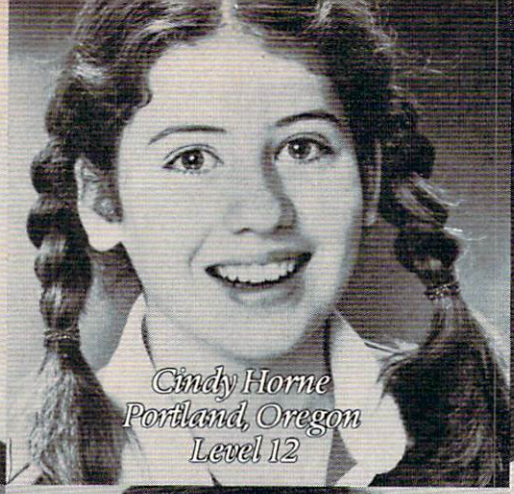
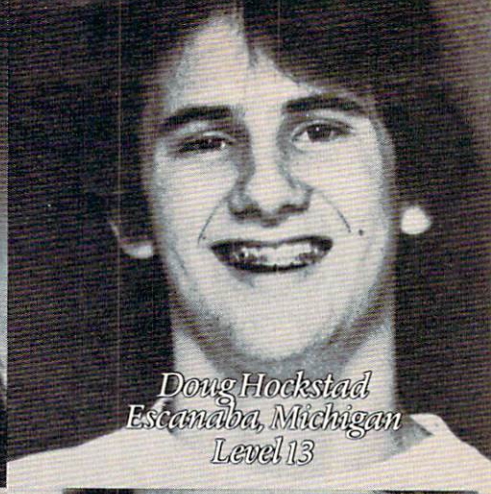


Larry Barbato
Springfield, Virginia
Level 13



Cindy Horne
Portland, Oregon
Level 12



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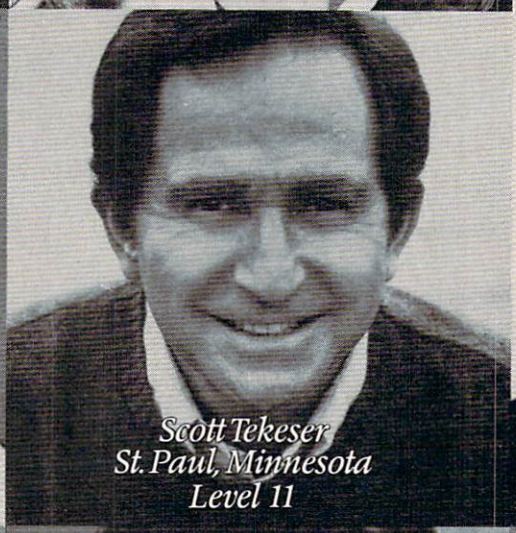

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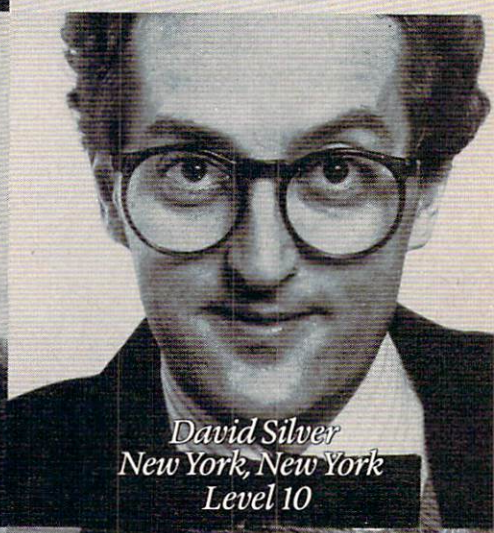

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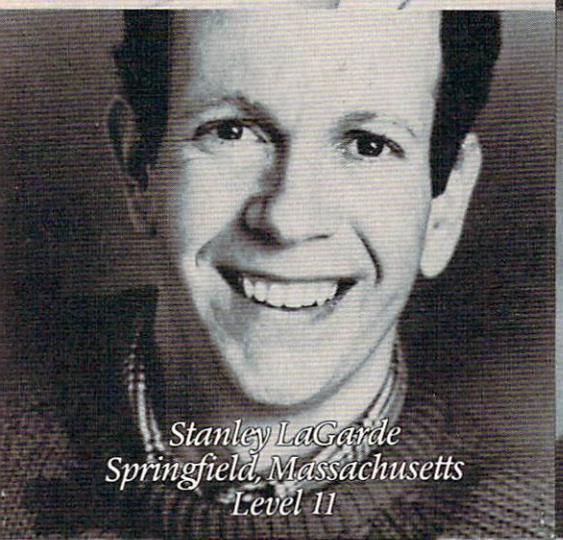

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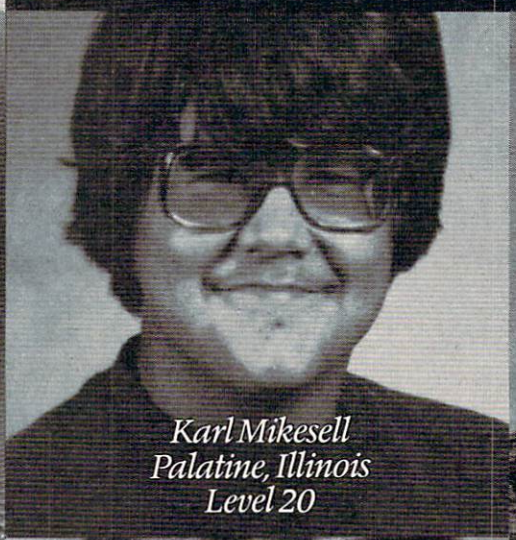

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Level 20

Mary McDermott
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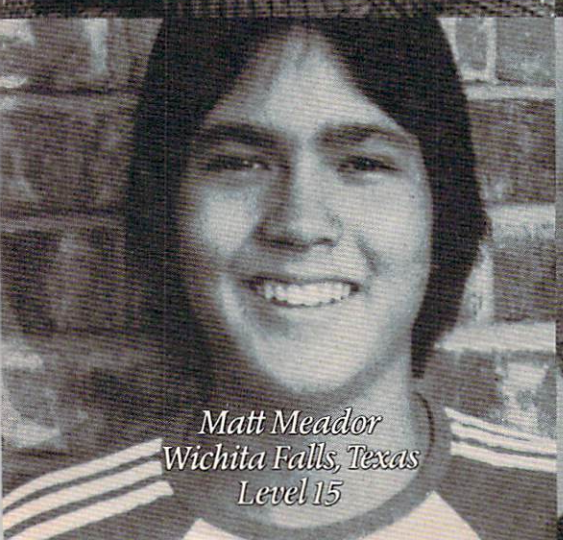
Level 10



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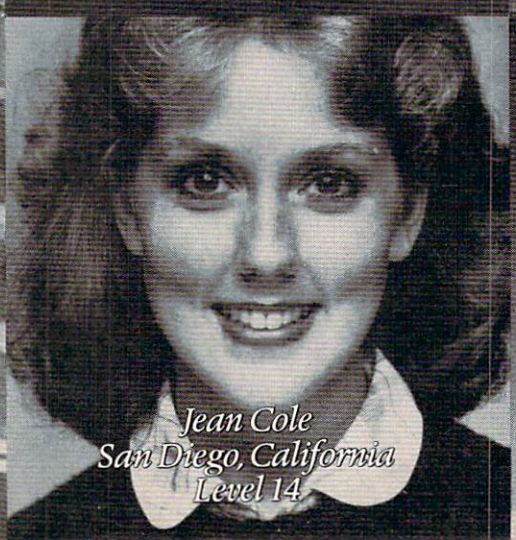

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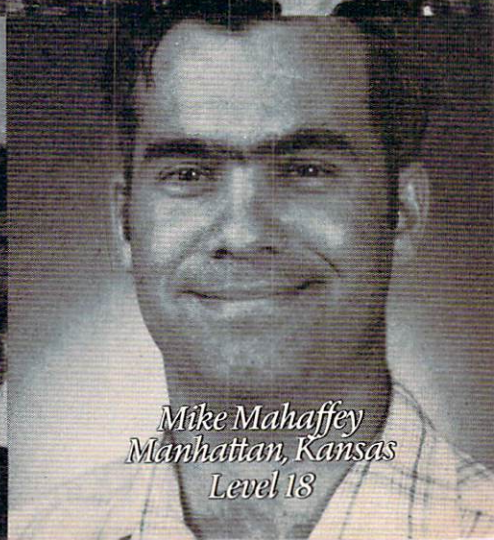

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point is that a word processor can relieve the tedium of recopying a manuscript by hand, and can go a long way towards developing and maintaining a child's creativity.

Other computer-based tools for creative expression (such as graphics tablets and picture generation software) can help maintain creative energy. In fact, the analytical computer can end up being a strong assistant to our creative expression — it can be high tech and high touch at the same time.

And so, with this view, I warmly embrace the forthcoming new year safe in the knowledge that we — through our sensitivities as human beings — have insured that Orwell's vision for 1984 will always remain fictional.

On Piracy And Example Setting

We all know that unauthorized copying and distribution of software is not only against the law, but also that it can drive good authors out of business. We may think that it is the lone programmer working in a back room who is most victimized by this practice, but large companies can be hurt, too.

Faced with dwindling school budgets, some teachers seem almost proud of their abilities to increase their school's software library at no net cost to the school.

If you think this doesn't happen, consider the case of a major educational publisher which understands that teachers want to evaluate software in their own classrooms before buying it. In an effort to be responsive to this reasonable expectation, the publisher made its software available on a 30-day trial basis. At the end of the 30 days, many of these products were returned. On close examination, the publisher found that the documentation binders had been opened and that some of the pages were reinserted in the wrong order — a sign that they had been copied along with the disks.

How could this company have prevented this significant financial loss at the hands of apparently unscrupulous teachers? Some might argue that the disks should have been copy protected, but copy protection works to the detriment of those who feel that they should be able to make legitimate backup copies of their disks. Also, for every software lock, there is a key available for a modest price.

What is needed is a new word in these teachers' vocabulary — ethics.

How prevalent is the problem? It's hard to say, but I have heard many teachers say that the reason they prefer Apple to Atari is because much of Atari's software is distributed on cartridges so you have to buy one for each computer in use. ©

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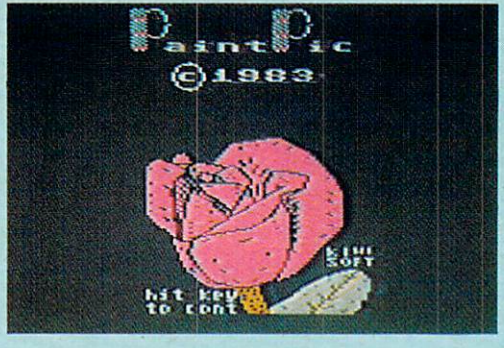

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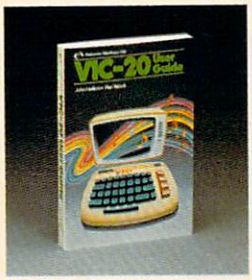

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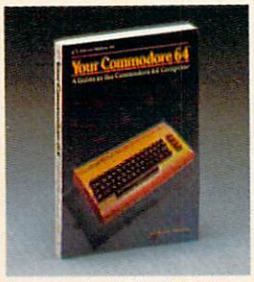

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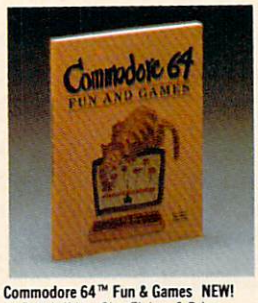

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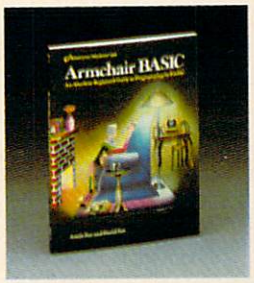

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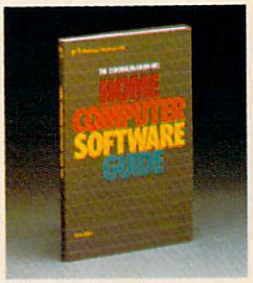

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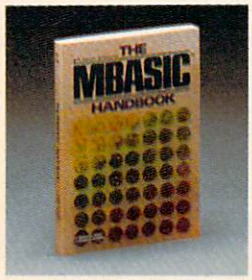
Every major home computer software package, including personal finance, investment, education, word processing and games is listed, summarized, and analyzed in this comprehensive reference guide.



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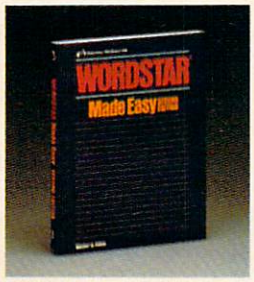

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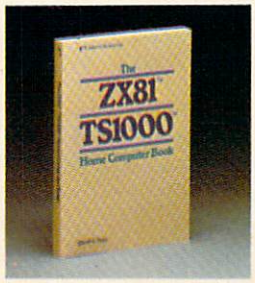

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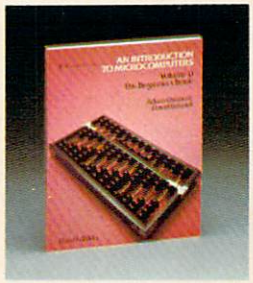

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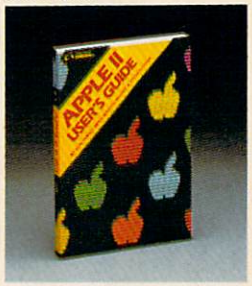

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The Christmas Of The Computer?

Kathy Yakal, Editorial Assistant

In December 1982, Time *gave the computer its annual "Man of the Year" award. Now Christmas of 1983 is being touted as the big one for these new machines, due to the market shake-out and radical price cuts over the last 12 months. Here's a review of the events of 1983 and a preview of how this Christmas is shaping up for the home computer industry.*

July is the month when many retailers begin making their Christmas plans—products are ordered for the busiest shopping season of the year.

In the summer of 1983, it certainly looked as if this might be the Christmas of the computer. The home computer market was in the midst of a big shake-out, and a few industry leaders had emerged. Competition, improved technology, and lower manufacturing costs had put the home computer well within the budgets of many American consumers. Announcements of some flashy new products and even further price cuts at the summer Consumer Electronics show in Chicago sent retailers and distributors scurrying to place huge orders.

Christmas notwithstanding, the emphasis on computers in education could have also meant big sales for hardware and software manufacturers in the back-to-school market. But in order for that to happen, hardware should have been in place and in great supply by August. It wasn't. Not one of the major hardware manufacturers seemed to be in a good position at that time to ship its products, due to production delays.

Let's back up a bit and look at what led up to this year's scramble.

Half The American Households

The personal computer industry is, of course, based on supply and demand. According to projections released at Future Computing's Second Annual Home Computer Market Forum in San Francisco, the viable hardware suppliers right now in the low end of the market seem to be Commodore, Atari, Texas Instruments, Timex, and Radio Shack. Future Computing (FC) reports that estimated monthly shipments by these companies are: Commodore, 160,000; TI, 100,000; Atari, 65,000; and Radio Shack, 35,000.

End users create the demand. Many studies have been done on just how high that demand is. Roughly, 1 out of every 20 households owns a computer now, but 3 out of 20 want to buy within the next year. By the end of the 1980s, more than half the American households are expected to have one, according to FC's study.

There are lots of reasons why people want to buy computers. Keeping up with the status quo. The fear that if their children don't have a computer at home, they will be left behind in school. That eternal desire to get organized once and for all. And, of course, videogames.

How people choose which computer to buy has also been the subject of much study. Some rely on the recommendations of salespeople in computer stores, but that has become increasingly difficult. Computers often appear on the shelves of mass retailers and discount houses where employees may not know a lot about the product. Others depend on the media for their information: computer books, magazines, and television shows. Probably the most common method is advice from friends.

Complicating Things

There is a third aspect which complicates the issues of supply and demand: software.

Third-party software publishers often do not want to start developing and marketing software for a computer until there is a healthy installed base. But this is a software-controlled industry:

...and one day people will be able to send mail by satellite right from their own homes.

Who would have thought it possible?

Now a new software package makes Western Union mail by satellite services available through your personal computer.

POSTMAN from Sydney is a remarkably simple program to use. Just type your message into the format on the screen and your letter is instantly transmitted by Western Union's satellite and mail network.

Mailgram® messages can arrive overnight anywhere in the U.S., Canada and Puerto Rico. E-Coms® are beamed to a receiving Post Office for priority delivery. And Computer Letters are an inexpensive Telegram look-alike that arrive with the speed of First Class Mail.

The POSTMAN package costs $44.95 complete; there are no additional subscription fees. Western Union charges will be billed to a special account or your credit card.*

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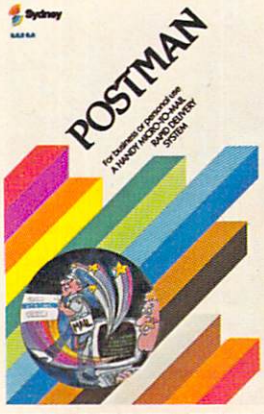

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CHOPLIFTER*
For the Commodore VIC-20.

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Now you can play some of America's hottest computer games on your Commodore, and get a FREE introduction to Home Management Software. It's our way of showing you that action-packed gaming is only the beginning of your Commodore's capabilities.

C R E A T I V E

*SELECTED AS SOME OF THE "MOST INNOVATIVE COMPUTER PROGRAMS" 1983 CES SOFTWARE SHOWCASE AWARDS.

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SERPENTINE*
For the Commodore VIC-20.

In the Kingdom of Serpents, the only rule is eat or be eaten. Three huge and evil red snakes are slithering through a complex series of mazes, closing in on your good blue serpent from all sides. Move fast and watch your tail! Try to survive long enough to let your eggs hatch into reinforcements. Swallow the magical frogs or your enemy's eggs and you can get the strength to go on... but look out to your left... and ahead of you! They've got you surrounded, and it looks like meal time.

It can teach you. Manage your family finances. Even help you buy a new car. And now, for a limited time only, when you buy one of our specially-marked games you'll receive a certificate good for one of our Home Management Programs absolutely free.

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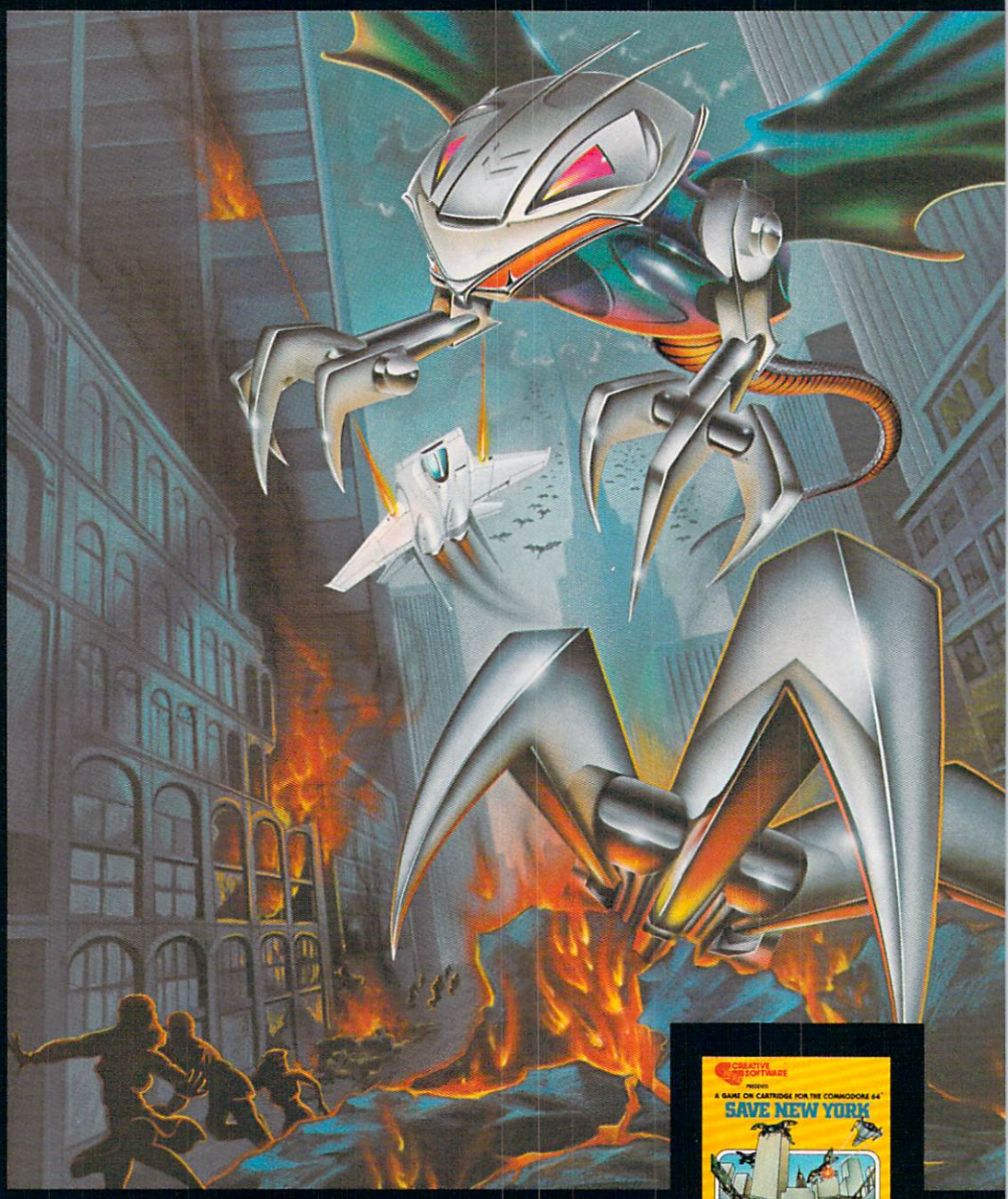
Get Creative!

SAVE NEW YORK™
For the Commodore 64.

It was as peaceful a day as New York ever gets, when suddenly the sky went dark and a monstrous droning noise filled the air. Hordes of grotesque aliens were swooping down from all sides, biting into the Big Apple as if they hadn't eaten for days. They were laying eggs, too. Horrible slimy things that got down into the subway tunnels and began clawing their way up. If anyone was going to save the city, it would have to be me. I leapt into my rocket and began blasting away. I thought I stood a fighting chance, but fuel's running low. . . another wave of invaders on the horizon . . . signing off. . .



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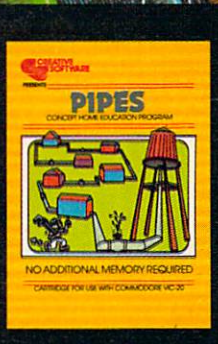
Get more out of your Commodore.



PIPES*
For the VIC-20 and Commodore 64.

Arlo is a hard-working plumber, but a touch absent-minded. He's building a water supply system for the whole neighborhood, and he really has his hands full. Help Arlo decide what kind of pipe to buy and where to put it . . . his limited budget doesn't leave him much margin for error. Figure out the shortest, most economical way to get everyone hooked up . . . and just hope poor Arlo has remembered to open and close the right valves. A marvelously entertaining and challenging exercise in planning, economics and spatial relationships for all ages.

Look for complete promotional details inside each specially-marked box of our year's biggest hits. Or talk to your Creative Software dealer. See how creative your Commodore really can be!

C R E A T I V E

*SELECTED AS SOME OF THE "MOST INNOVATIVE COMPUTER PROGRAMS" 1983 CES SOFTWARE SHOWCASE AWARDS.

Offbeat Gifts And High-Tech Whimsy

You've already seen the beginnings of it. T-shirts and bumper stickers with clever computer sayings on them. People's faces digitized and put on buttons. Little foam bats to "beat" your computer. High-tech whimsy.

Several companies have introduced products in this lighter vein that you may want to consider for gifts this year.

The Computer Tie

Designed to interface your wardrobe with your computer, these ties are woven in a navy blue silk and polyester blend with the words BIT/BYTE/FLOPPY/HARD/RAM/ROM/MICRO/MINI written in a continuous pattern on them. One size fits all. $15.95. (Tie-One-On, Inc., P.O. Box 40225, Philadelphia, PA 190106)

Milk Chocolate Diskettes

Sweetware, Inc., which specializes in edible reproductions of high-technology objects, has just introduced what they consider the ultimate high-tech gift: the Milk Chocolate Eat-Only Diskette. The diskettes come in pairs (a half-pound of chocolate) in a gift box.

Company vice president Alan Levu says that the chocolate diskettes make an ideal gift for anyone who uses computers, and even dedicated computer haters will get a chuckle out of them. They're guaranteed "user-delicious."

Sweetware sells the diskettes by mail order and through department stores and computer retailers. (Sweetware, Inc., 516 Shelburne Rd., S. Burlington, VT 05401)

The bitCard

These software packages/greeting cards are actually graphics and text adventures that relate to a specific holiday or event. The first in a series of bitCards, "A Christmas Adventure," can be customized with references to the recipient, and programmed to deliver a personal holiday greeting to him in whatever words the sender wishes. This message appears as part of an animated graphics scene — the player's reward for completing the adventure. The bitCard draws the player into a fantasy world in which he is a participant.

Available for Apple II+/e, 48K disk; 16K cassette for Atari 400/800, TRS I/III/CC, and Commodore 64. Cassette version also available for 5K VIC-20 and VIC-20 with 8K RAM expansion. $16.95 all versions. (bitCards, 120 South University Drive, Suite F, Plantation, FL 33317. bitCards is a subsidiary of CHARTSCAN DATA, Inc.)

Computerized Greeting Cards

Another way to personalize your greeting cards by using your computer is available from Compucards. The package consists of Christmas cards and envelopes with continuous tab feed and clean edge perforations that let you write a message on each card, address it, and print it out. The accompanying diskette contains an upgraded version of the public-domain program Tinytext, which has message-merge capabilities and a separate mailing list program. Both programs come with instructions on diskette.

For Atari computer owners (800 with 48K and disk drive). Package of 20 cards and envelopes, $9.95. Diskette, $5. (Compucards, P.O. Box 894, Stone Mountain, GA 30086)

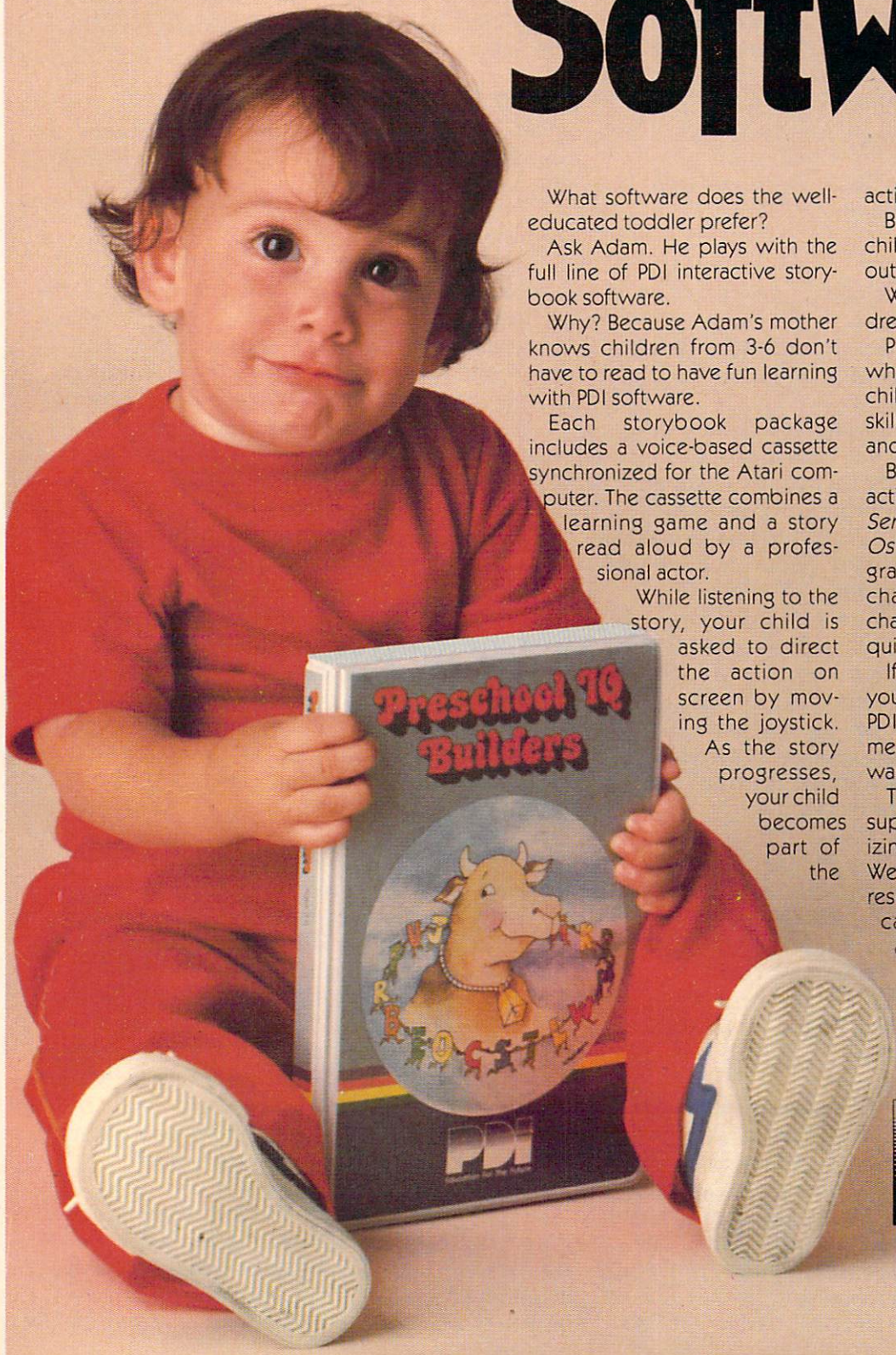
Many people do not want to buy a computer until there is a lot of software to support it. It's a vicious circle. Those computer manufacturers that managed to survive the shake-out did so partly by having enough in-house software available to please consumers until third-party packages could be developed.

Pipe Dreams

Let's recap the highlights of 1983.

- Coleco introduced a prototype of a new personal computer called Adam at the summer Consumer Electronics Show. Slated to retail at under $600, this system consists of an 80K computer with detachable keyboard, high-speed tape drive, letter quality printer, and built-in software.
- Atari discontinued its 400 and 800 models and shelved the 1200XL. A new line was introduced at the summer CES: the 600XL, 800XL, 1400XL, and 1450XLD. A good number of new peripherals and some corporate restructuring were also expected to help capture a greater percentage of the market share.
- Commodore slashed its hardware and soft-

Baby's First Software.



What software does the well-educated toddler prefer?

Ask Adam. He plays with the full line of PDI interactive storybook software.

Why? Because Adam's mother knows children from 3-6 don't have to read to have fun learning with PDI software.

Each storybook package includes a voice-based cassette synchronized for the Atari computer. The cassette combines a learning game and a story read aloud by a professional actor.

While listening to the story, your child is asked to direct the action on screen by moving the joystick. As the story progresses, your child becomes part of the action, while acquiring new skills.

Best of all, the voice track helps children use PDI programs without assistance.

When PDI programs talk, children listen. And learn.

Parents will listen, too. And what they'll hear is the sound of children developing pre-reading skills, including letter recognition and number concepts.

But more than talk, we've got action, too. From *Sammy the Sea Serpent* to the *Adventures of Oswald,* all PDI Pre-School programs include bright colors, charming music and friendly characters children warm up to quickly.

If all that's not enough to sell you on PDI software, this should. PDI has commissioned a study to measure the effects of our software on pre-school children.

The study, a first of its kind, was supervised by educators specializing in pre-school development. We'll be glad to send you the results, if you'll send us a postcard with your name and address to:

"The PDI Pre-School Study"
c/o Program Design, Inc.
95 East Putnam Avenue
Greenwich, Conn. 06830

PDI
Program Design, Inc.

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ware prices and announced several new software packages midyear. Commodore 64s have been selling for under $200, VIC-20s for under $100. Peripheral prices have also been reduced dramatically, making Commodore's personal computer packages some of the most attractive in the market.

- Rumors began circulating about a new IBM personal computer called the Peanut, which was expected to retail for under $600. Industry leaders had predicted that IBM would wait for the home computer market to shake out under them before they introduced a competitively priced product; late 1983 seemed to be that time.
- Mattel Electronics announced a home computer system called the Aquarius and a computer adapter that would turn the Intellivision game machine into a computer. Both machines were to have a number of peripherals.

A Few Snags

All of these new products could have meant a very healthy holiday season for the home computer industry. But manufacturers encountered a few problems between summer announcements and fall shipping schedules.

Coleco's Adam, after a couple of earlier delays that kept it from making its August debut, finally received FCC approval in early October. Production models were expected to be in the stores by mid-October, possibly too late to make a dent in the Christmas market. Some retailers gave up and began cancelling orders in early fall.

Commodore's hardware manufacturers have not been able to keep up with the demand. Disk drives vanished entirely for a few weeks in the fall, reappearing again in early October. Commodore 64s were in short supply and began evidencing some technical problems; some retailers have reported unusually high return rates. Software is plentiful, but so are back orders on hardware. Many retailers still believe there is a good chance that it will be a Commodore Christmas.

Atari still had not brought out any of its new XL line by mid-October. A spokesman said that the 600XL and 800XL should be out in time for Christmas, and that the 1400XL and 1450XLD would probably be ready for shipping in the first quarter of 1984. The add-on keyboard for the 2600 game machine, which is not yet available, is apparently still being considered.

Texas Instruments suffered tremendous financial losses in the first two quarters of 1983. They lowered their prices and embarked on an enormously expensive ad campaign to capture the Christmas market, but they had already lost a lot of the market to Commodore and Atari. Their new strategy is to emphasize the quality and educational value of their machines.

IBM's Peanut failed to appear in time to capture any great percentage of the potential holiday buyers. Speculation is that the debut had been put off until January.

The Mattel Aquarius Home Computer System is being distributed—minus several of the announced peripherals—in only four markets: Los Angeles, Chicago, Atlanta, and Detroit. The computer adapter, also without some of its add-ons, is still expected to be available around Christmas.

Massive layoffs by Atari, Texas Instruments, and Mattel, as well as all of the no-shows, did nothing to instill public confidence.

Some Good News

Availability of hardware is not the only determining factor in how successful this Christmas will be for the industry.

"People need to remember that we've crossed the bridge over to what is now a software-driven industry," says Dan Schaefer, vice president of marketing for Warehouse One, a Norwood, Massachusetts, software distributor. "People are no longer so enticed by fancy keys on computers—they want to know what they can do with their computers, what kind of software will support it."

Schaefer is not nervous at all about losing business this year because of absent hardware. "There's a tremendous installed base of Ataris, Commodores, TIs, and IBM-PCs," he says. As of October 1, Warehouse One began keeping their main distribution center in Kansas open until midnight on weeknights and all day Saturday, and offering next-day delivery, to help retailers keep up with the Christmas demand.

"Last Christmas was enormously successful for retailers, and that was at a time when the economy was terrible," Schaefer says. "Considering the economy this year, and the demographics of the average computer buyer, this should be an exceptionally good one."

The tardy arrival of this year's new hardware does not particularly surprise Schaefer. "Anytime a new industry emerges, this happens. Products are announced long before they are actually available. The hope is that if the product sounds good enough, people will hold off buying something that already exists until they see what this other company comes up with.

"Some people in this industry have a tendency to dwell with glee on other people's failures," says Schaefer. "This is an extremely dynamic industry: it changes every day. There is still plenty of opportunity for the smart businessman."

So consumers may be a bit disappointed by potentially limited choices this December, but at least one sector of the home computer industry is looking forward to a very successful holiday season—software publishers and distributors. ©

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Timex introduces a second generation of home computers designed with one purpose in mind: to be useful.

With 72K on-board memory, it's powerful enough to solve more problems in your home. Entertain you with brilliant color graphics and 8-octave sound.

Plus do word processing in addition to spread-sheet functions.

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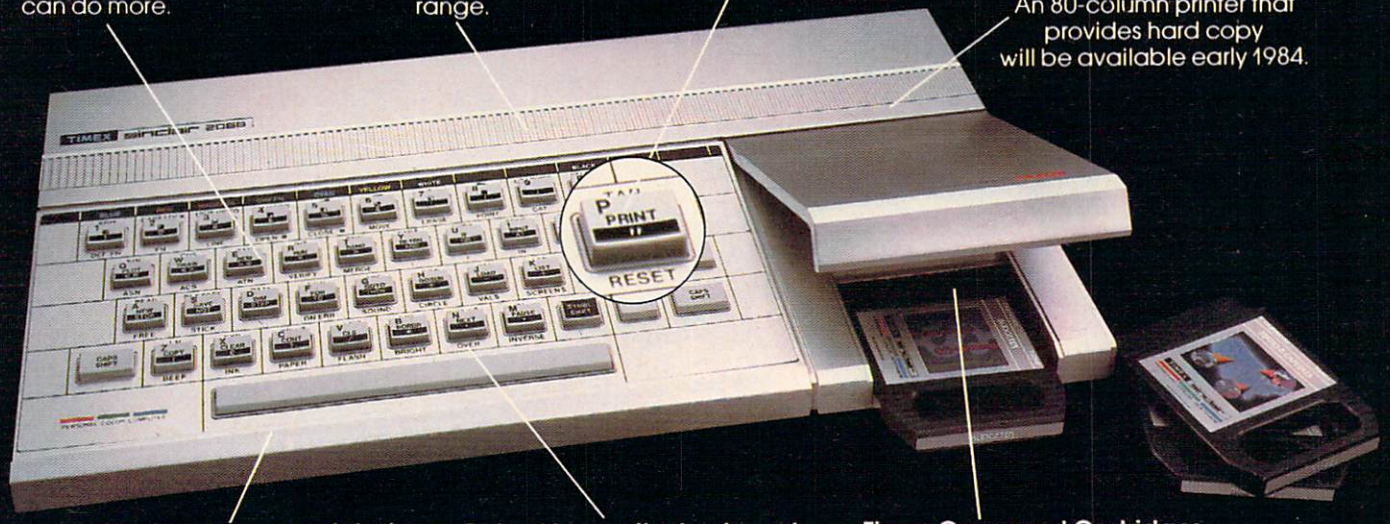
Finally. A home computer you can really use in your home: the Timex Sinclair 2068.

72K on-board memory. More memory than any computer in its class. And more memory means you can do more.

8-octave sound. Can be used to create four sounds simultaneously over a wide frequency range.

Unique one-touch entry. Requires no typing skills; makes programming easier to learn.

Word processing capability. This program provides a 64-character wide screen when used with a video monitor. An 80-column printer that provides hard copy will be available early 1984.



Sleek new compact design. Fits easily on any desk or table.

Raised typewriter keyboard. With full-travel keys is based on world's most popular electronic keyboard design.

Timex Command Cartridges. Provide faster, easier program loading, take up less space.

TIMEX SINCLAIR 2068

To purchase the Timex Sinclair 2068 computer see your local dealer, or call 1-800-24-T-I-M-E-X.

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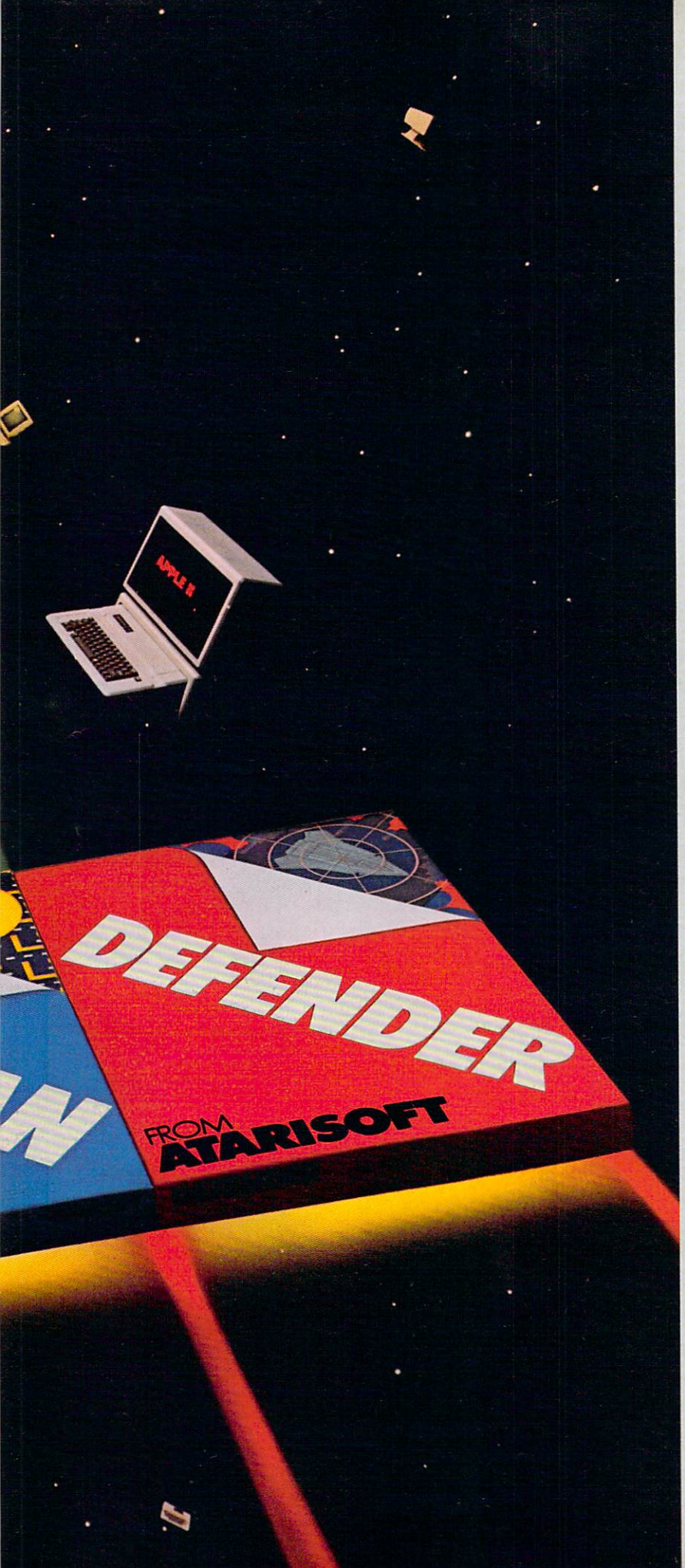

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Richard Mansfield, Senior Editor

Zones Of Unpredictability
Part 2

The RND command is a necessary part of most computer games or computerized simulations of real events. That's because life (as far as we know) has a random quality. Perhaps it's our limited viewpoint, but some things do seem to be accidental. When you play Poker, or if you write a Poker game on your computer, you'll see randomness in action. When cards are shuffled and dealt, something accidental, something unpredictable is supposed to happen — no one knows what order the cards are in when they are passed around.

Last month we explored some of the general rules for working with the RND command in BASIC. However, since it is one of the less *transportable* of the BASIC instructions, we need to go into some of the specific differences in the ways that each particular computer handles RND. *Transportable* means the ease with which a program written in one computer's BASIC will run on another's BASIC. There are always a few adjustments to make, but some programs are so machine specific (especially graphics programs) that they're very hard to translate and are, therefore, not very transportable. Different computer brands tend to have specific peculiarities in their use of RND.

But before looking into the particular use and syntax of RND on your computer, let's run a brief test of the randomness of your RND. RND on any computer is an effort to cause accidental, unpredictable results. The more unpredictable, the better. One simple way that we can test your RND is to see if it favors one number over another. If we limit the test to the numbers 1 through 10, will it hit, say, 3 more often than 7?

Type in the program and RUN it. You'll see the statistics on how often each number is turning up. Ideally, you'll end up with 10 percent for each number. At first, of course, the percentages will be off, but if you let the program run for a while, you should get pretty close to even distribution.

There are a few general programming techniques to notice here. If you add up the percents, you won't get precisely 100 percent. That's because we're using the INT command to round off the numbers printed on the screen. The computer is working with extended decimal fractions, but for neatness, we're not printing everything out. Take off the INT to see how messy things get. Also look at line 40. Here 1 is added to X each time we get a random number. That's so we'll have numbers 1 – 10 instead of 0 – 9. Remember that an array (a collection of numbered variables) will start with zero. That is, A(0) is the first "cell" in an A( ) array. To make it easier for us to keep straight, we can just ignore the A(0) cell and work with the cells from 1 on up.

Can you tell why line 100 is necessary? At the start of our test, some numbers won't come up at all. They will leave a zero in their A( ) array variable cell. The computer won't allow you to divide by zero. So, we need to put in a special test for zero and then skip over line 110 where the division would normally occur.

Special Seeding

There's an important aspect of randomness which is not tested by this program: order of arrival. A computer which gave the numbers 1 through 10 in order, each cycle through the test, would look perfect on the test. The distribution would be exactly 10 percent, but it certainly wouldn't be a good randomness generator. There are two aspects to the randomness of the order of arrival of numbers. First, you don't want the same sequence of random numbers each time you turn on the computer. We'll call this the start-up sequence. With a repeating start-up sequence, each time

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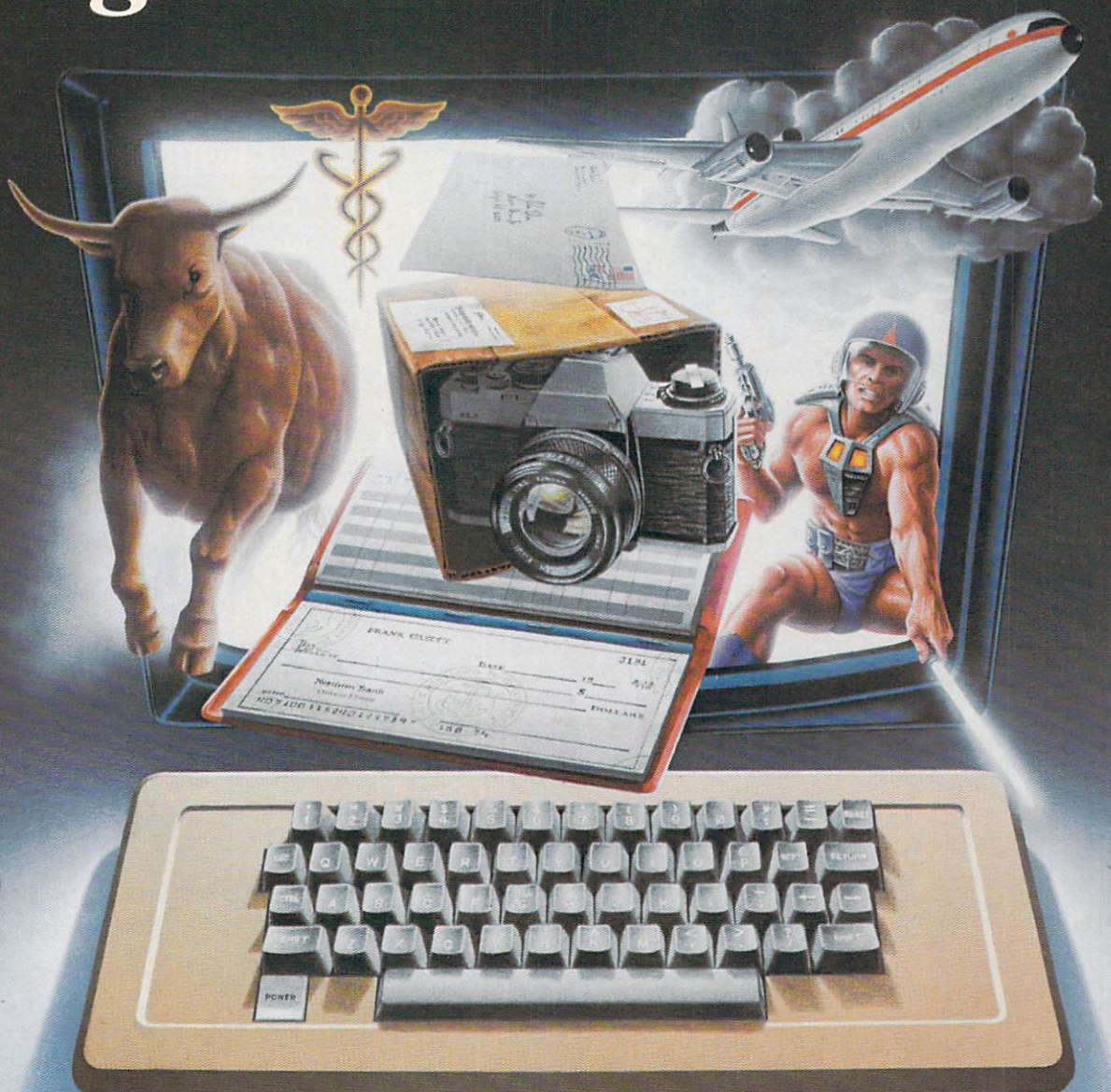

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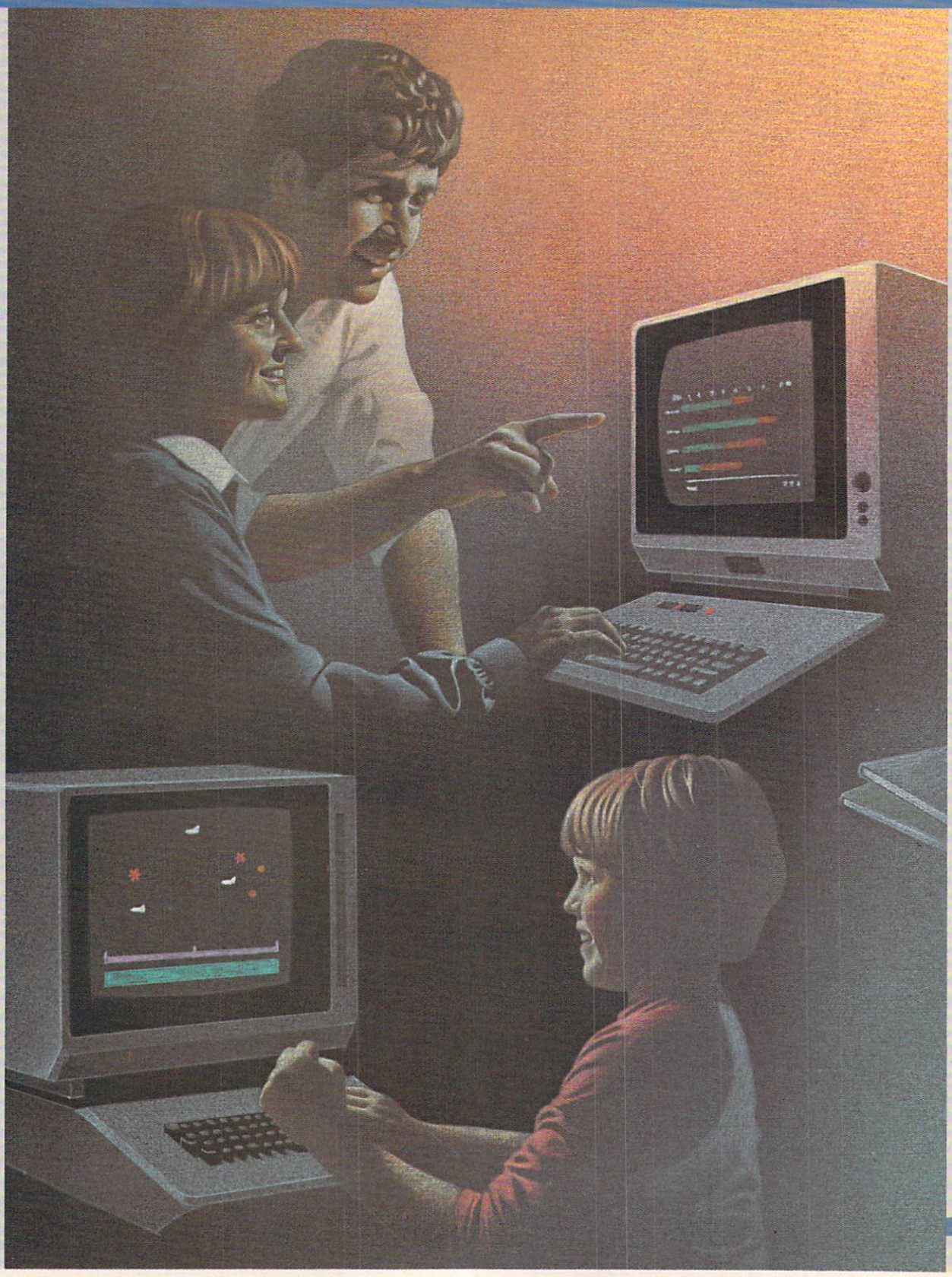

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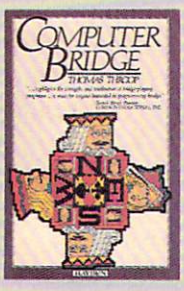

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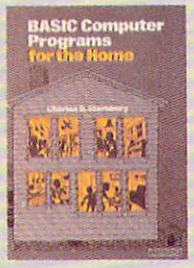

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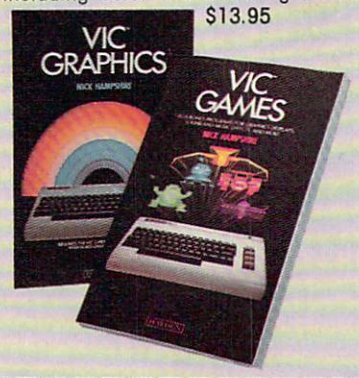

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you played Poker the first hand of the evening would be identical to the last night's first hand. And the second hand would match last night's second hand. And so on.

The second aspect is repeating sequences within a program. You don't want to have a short sequence of random numbers that starts repeating itself (1534215342...). Last month we dealt with both of these issues and discovered that, in fact, the order on several computers is *not* random unless you take a special step to mix things up.

The special step is called *seeding* and it means using something random as a starting place. Computers are relentlessly logical. It's not easy for them to do things accidentally, to create randomness. So, they use a special *algorithm* (a method) to try to mix things up. The RND command takes a number (the seed), turns it inside out (by "rotating" it in its binary form), multiplies it by itself, rounds it off, and so forth. All this twisting and turning is designed to come up with an unexpected number. However, if the starting place is the same, the result will be the same. The same algorithm is used each time. That's where random seeding comes in.

It's Fast. You're Not.

If you give RND a seed from the computer's ultrafast, *realtime* clock, you won't get the same seed twice. (Realtime means time which passes as humans use it: 60 minutes to an hour, etc. All computers have internal timers, but not all have clocks that keep realtime.) That's the method used by all of our computers except the Apple; it has no realtime clock. Why don't you ever get the same seed when it comes from the clock? Because this clock is terrifically fast and you're not. The time it takes you to turn on the computer, type RUN, and hit RETURN is never exactly the same. Consequently, the start-up time for a game will depend on *you* and that's plenty random by computer standards: if you bat an eyelash, the computer clock has registered hundreds of time cycles. In any case, you'll need to know how to work with your particular RND, and it will help you translate programs from alien BASICs if you also have some idea of how the other computers use RND. Here are some notes on how to use RND on several popular computers:

- Commodore Computers. You can first seed the RND with (TI), the special variable which holds the current value of the clock. To do this, you would write a line early in your program like this:

```
10 A=RND(-TI)
```

This will cause the computer to provide a different sequence each time the computer is turned on. That is, the seed will depend on the clock and it will be called upon when you type RUN to start the program. To insure that calls to RND later in the program are also highly random, use RND (0).

- Atari. There are no special requirements for the Atari. It seeds the RND generator itself. Whenever you call upon RND, you'll get both randomized as well as different start-up sequences each time the computer is turned on. The syntax is the same as Commodore: A=RND (X). It doesn't matter what X is.

- TRS-80 Color Computer. Same syntax, but use RND (0) to achieve both randomized sequences and random start-ups.

- TI-99/4A. Using RND alone will result in identical sequences. To avoid that, you should use the additional command RANDOMIZE early in a program:

```
10 RANDOMIZE
100 A=RND
```

Further, our TI columnist, C. Regena, suggests using RANDOMIZE before each call to RND to insure total randomness.

- Timex/Sinclair. To call the clock for a seed, you should put the following line early in a program:

```
10 RAND 0
```

and then call RND the same way the TI does (no argument in parentheses):

```
100 A=RND
```

RND, when it follows RAND 1 – 65535 (any of these numbers), will result in a repeating sequence of "random numbers" which is the same each time power is turned on (if you use the same number after RAND). The computer generates 65536 numbers to use for its random numbers. The number following RND determines the entry point into this sequence of numbers. However, when you use zero after RAND, the entry point into the list of numbers is determined by how long the TV has been turned on. This is essentially the same solution that the Commodore computers use.

- Apple. Because the Apple doesn't contain a clock, the best way to seed the RND is to ask the user to hit a key, within a loop:

```
10 PRINT "Press RETURN when ready to start"
20 IF PEEK (-16384) < 128 THEN A=RND(1):
   GOTO 20
```

This will give you a random seed to prevent start-up sequence repetitions. The value in address −16384 will remain below 128 until a key is pressed. Thus, you'll keep reading off numbers via the RND, but will have reached an unpredictable position in the list by the time you hit RETURN. Following that, use RND (1) for the best randomness. There is a bug, however, in the Apple's BASIC which causes the sequences to

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start repeating themselves rather quickly. There's no cure for it.

One final note about RND. If you're writing a game, one way to test it is to deliberately violate the randomizing rules we've mentioned above. There are cases when you will *want* to have a repeating, nonrandom sequence of numbers to check things within the program. If that's what you're after, you can leave out the randomizing seeds and test things against the resulting known, predictable patterns.

Randomness Test

```
10 GOSUB 500
20 FOR I = 1 TO 100
30 T = T + 1
40 X = INT (RND (1) * 10):X=X+1
50 A(X)=A(X)+1
60 NEXT I
70 GOSUB 500
80 FORI=1TO10
90 PRINT I;
100 IFA(I)=0THENPRINT"-- 0%":GOTO120
110 PRINT"--";INT(T/A(I));"%"
120 :NEXT I
130 GOTO 20
500 PRINT"{CLR}": REM CLEAR THE SCREEN
510 RETURN                                    ©
```

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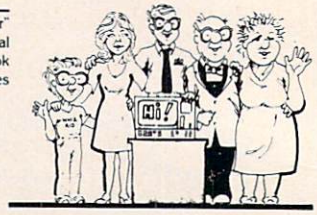

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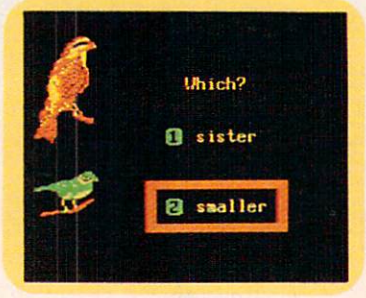

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Gerald P. Graham

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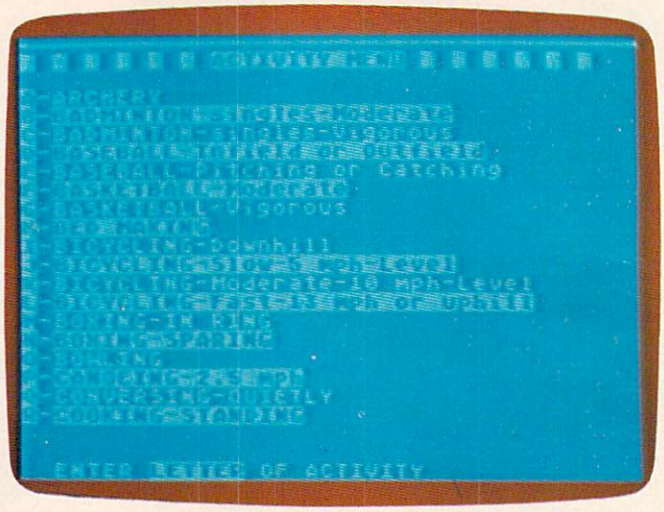
In the December 1982 issue of COMPUTE!, Charles Brannon presented a program for calculating the calories in your diet. It also estimates your daily needs and then predicts how long it will take you to get rid of any extra weight you want to lose.

"Calorie Cop" is a companion program which determines the caloric output for each activity you perform. It also calculates the calories expended for each activity so you can see your total daily energy output. When you RUN the program you are given instructions and then a seven-page, alphabetical menu of activities from archery to wrestling. Just press the letter corresponding to your activity, and if you don't see it, continue to press RETURN to turn the pages until you find it. If your activity is not listed, then use one that is comparable.

Keep in mind that the results should be modified by knowledge of the context of the activities. Some activities require greater skill and coordination than others, thus a higher caloric output. In cases where an unskilled person is competing against a skilled person, the former usually works harder. Desire and effort are also factors. One research study involved filming very heavy individuals playing tennis doubles. The very heavy players were found to be standing 65 percent of the time. Whereas vigorous tennis doubles requires .046 calories per minute per pound of weight, standing is worth only .011 cal/min/lb.

Do not use this or any other diet/exercise program except under the advice and consent of your physician.



Many different options are available in "Calorie Cop." Atari version.

Program 1: Calorie Cop (Atari Version)

```
5 GRAPHICS 0:CLR
10 DIM NAME$(20)
12 GRAPHICS 18
14 POSITION 5,4:? #6;"CALORIE COP"
30 FOR DELAY=1 TO 2500:NEXT DELAY
35 SETCOLOR 0,0,0
40 FOR DELAY=1 TO 400:NEXT DELAY
55 GRAPHICS 0:SETCOLOR 4,2,10:SETCOL
   OR 3,0,4:COLOR 1:POKE 752,1
60 ? :? :? "THIS PROGRAM WILL TELL Y
   OU HOW MANY":?
62 ? "CALORIES YOU USE FOR A PARTICU
   LAR":?
64 ? "ACTIVITY.  YOU WILL BE PROVIDE
   D AN":?
66 ? "ACTIVITY MENU THAT WILL TELL Y
   OU HOW":?
68 ? "MANY CALORIES EACH ACTIVITY US
   ES EACH":?
70 ? "MINUTE FOR EACH POUND OF YOUR
   BODY":?
```

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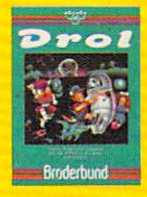

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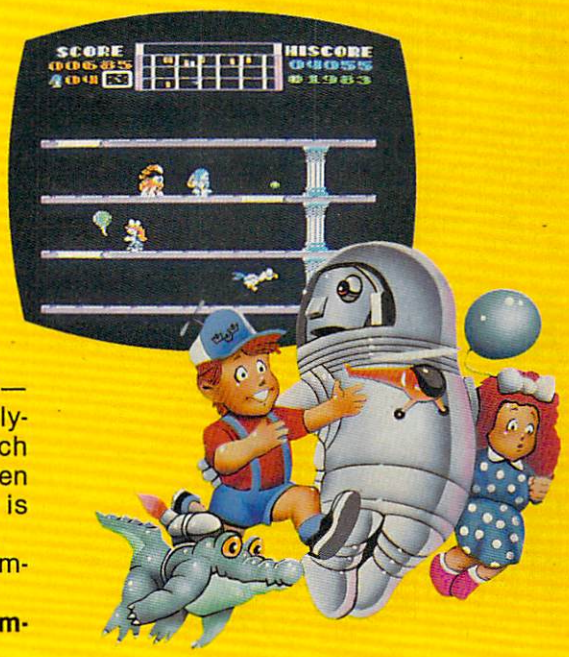

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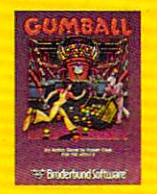

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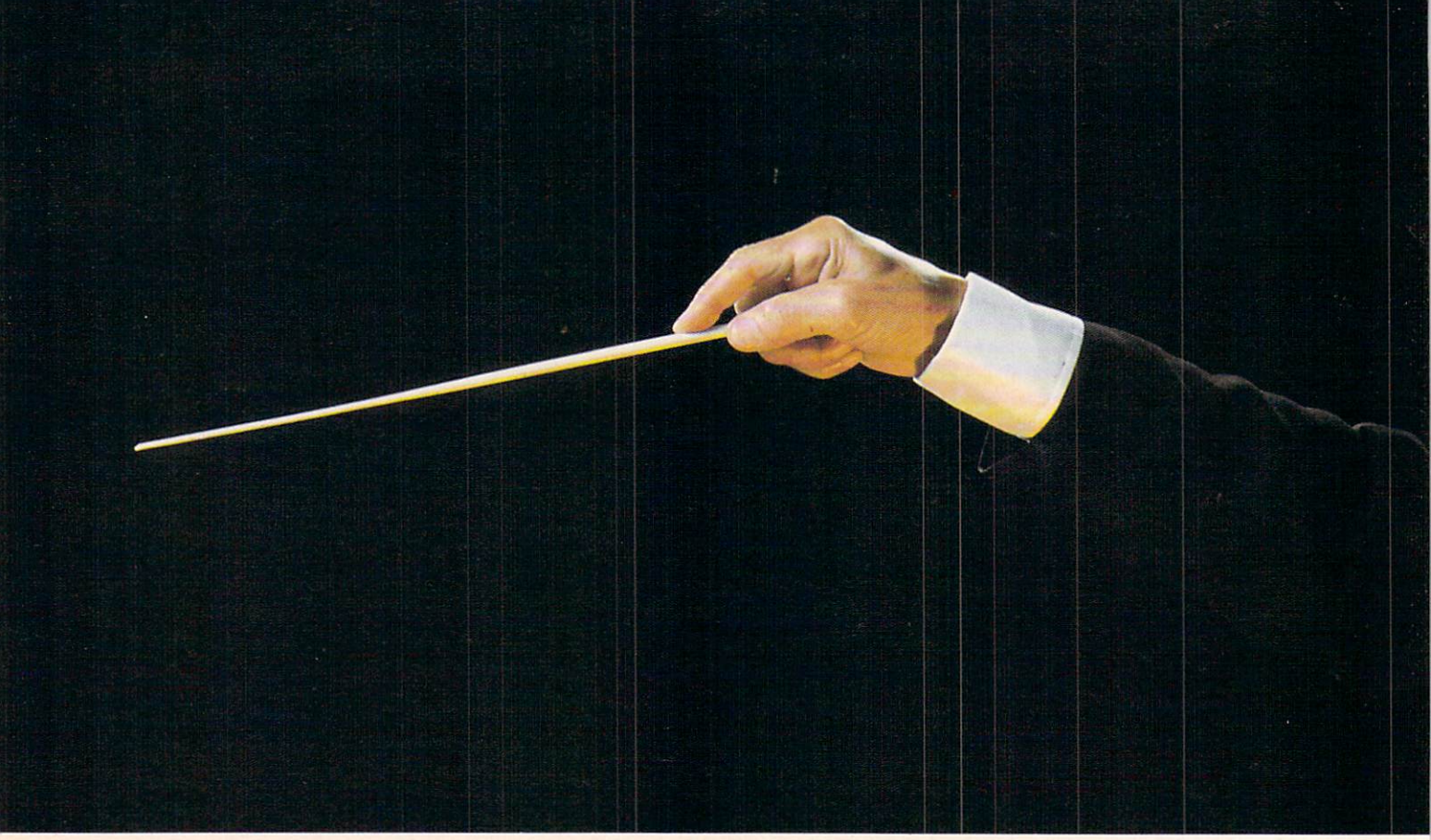

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It's just like a movie.

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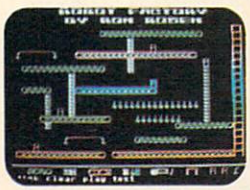

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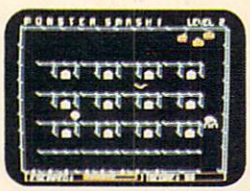

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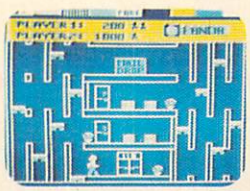

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```
72 ? "WEIGHT.  IT WILL ALSO GIVE YOU
   A TOTAL"
74 ? "OF ALL CALORIES USED.  PLEASE
   WAIT FOR":? "THE MENU TO APPEAR."
78 FOR DELAY=1 TO 5000:NEXT DELAY
80 GRAPHICS 0:SETCOLOR 4,2,10:SETCOL
   OR 3,0,2:COLOR 1
100 GRAPHICS 0:POKE 752,1
105 OPEN #1,4,0,"K":POKE 82,0
110 DIM A$(1),ACTIVITY$(39),AMOUNT$(
   4)
250 IF CAL THEN 730
260 PX=0:PY=3:GOSUB 1020
270 FOR I=1 TO 18
280 READ ACTIVITY$,CL
290 IF ACTIVITY$="END" THEN 330
300 POSITION PX,PY:PRINT CHR$(I+192)
   ;"-";ACTIVITY$:PY=PY+1
320 NEXT I
330 REM
340 IF PEEK(20)>60 AND PEEK(20)<120
   THEN POSITION 2,23:? "ENTER LETT
   ER OF ACTIVITY{12 SPACES}";
350 IF PEEK(20)>120 AND PEEK(20)<180
    THEN POSITION 2,23:? "PRESS RET
   URN TO GO TO NEXT PAGE";
360 IF PEEK(20)>180 THEN POSITION 2,
   23:? "PRESS * WHEN DONE
   {20 SPACES}";:POKE 20,0
365 IF PEEK(764)=255 THEN 340
370 GET #1,A:A$=CHR$(A):IF (A$<"A" O
   R A$>"R") AND A$<>CHR$(155) AND
   A$<>"*" THEN 340
380 IF A$<>CHR$(155) THEN 410
390 NX=NX+1:IF ACTIVITY$="END" THEN
   RESTORE :NX=0
400 GOTO 260
410 RESTORE
420 IF A$="#" THEN 600
430 IF A$="*" THEN 660
440 FOR I=1 TO NX*18+ASC(A$)-64
450 READ ACTIVITY$,CL
460 NEXT I
475 GRAPHICS 0:SETCOLOR 4,3,0:COLOR
   1
480 ? :? " ACTIVITY: ";ACTIVITY$
490 ? :? " THIS ACTIVITY USES ";AMOU
   NT$;CL:? " CALORIES PER MINUTE P
   ER POUND"
500 ? :? " IF YOU TYPED THE WRONG LE
   TTER THEN"
505 ? " ENTER ZEROS BELOW"
510 ? :? " ENTER LENGTH OF ABOVE ACT
   IVITY"
520 TRAP 520:PRINT " IN MINUTES";:PO
   KE 752,0:INPUT MIN:POKE 752,1:TR
   AP 40000
530 IF MIN=0 THEN 590
540 IF MIN<0 THEN PRINT "{DOWN}
   {BELL}":GOTO 470
550 ? :? " ENTER YOUR BODY WEIGHT IN
    POUNDS":INPUT LBS
552 IF LBS<0 THEN PRINT "{DOWN}
   {BELL}":GOTO 470
555 OUTPUT=LBS*MIN*CL
556 ?
557 ? " CALORIES USED FOR THIS ACTIV
   ITY= ";OUTPUT
558 ?
560 PRINT " TOTAL CALORIES USED SO F
   AR = ";:CAL=CAL+CL*MIN*LBS:PRINT
    CAL
570 ? :PRINT " PRESS RETURN TO CONTI
   NUE..."
580 GET #1,A:A$=CHR$(A):IF A$<>CHR$(
   155) THEN 580
590 RESTORE :NX=0:GOTO 260
650 MIN=1:GOTO 560
660 GRAPHICS 0:CLR
670 DIM END$(20)
675 GRAPHICS 2+16
680 POSITION 5,3:? #6;"THAT'S ALL"
690 POSITION 5,6:? #6;"  FOLKS"
700 FOR DELAY=1 TO 1000:NEXT DELAY
710 END
1020 PRINT "{CLEAR}";
1120 PRINT "{40 R}"
1125 ? "■ ■ ■ ■ ■ ■ ACTIVITY MENU ■
   ■ ■ ■ ■ ■"
1130 RETURN
1140 DATA ARCHERY,.034
1150 DATA BADMINTON-singles-Moderate
   , .039
1160 DATA BADMINTON-singles-Vigorous
   , .065
1170 DATA BASEBALL-infield or outfie
   ld, .031
1180 DATA BASEBALL-Pitching or Catch
   ing, .040
1190 DATA BASKETBALL-Moderate, .047
1200 DATA BASKETBALL-Vigorous, .066
1210 DATA BED MAKING, .031
1220 DATA BICYCLING-Downhill, .018
1230 DATA BICYCLING-Slow-5 mph-Level
   , .030
1240 DATA BICYCLING-Moderate-10 mph-
   Level, .050
1250 DATA BICYCLING-Fast-13 mph or U
   phill, .072
1255 DATA BOXING-IN RING, .101
1257 DATA BOXING-SPARING, .063
1260 DATA BOWLING, .028
1270 DATA CANOEING-2.5 mph, .029
1280 DATA CONVERSING-QUIETLY, .011
1290 DATA COOKING-STANDING, .013
1300 DATA DANCING-Slow, .029
1310 DATA DANCING-Moderate, .045
1320 DATA DANCING-Fast, .064
1330 DATA DRESSING & UNDRESSING, .03
   0
1340 DATA DRIVING A CAR, .019
1350 DATA DUSTING, .010
1360 DATA EATING, .011
1370 DATA EXERCISES-Abdominal, .020
1380 DATA EXERCISES-Balancing, .016
1390 DATA EXERCISES-Hopping or Jumpi
   ng, .043
1400 DATA EXERCISES-Trunk Bending, .
   023
1410 DATA FENCING-Moderate, .033
1420 DATA FENCING-Vigorous, .057
1430 DATA FIELD HOCKEY-Other than go
   alie, .063
1440 DATA FIELD HOCKEY-Goalie, .030
1450 DATA FISHING, .016
1460 DATA FOOTBALL-Backs & Ends, .05
   0
1470 DATA FOOTBALL-Linemen, .040
1480 DATA GARDENING, .030
1490 DATA GOLF-carrying clubs-Crowde
   d, .030
1500 DATA GOLF-carrying clubs-Uncrow
   ded, .035
1510 DATA GYMNASTICS-Light, .030
```

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The STX-80 printer for Christmas '83!

What a great gift idea!

It's the STX-80 printer from Star. Sleek, compact and priced under $200, it's sure to put you in a very giving mood.

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```
1520 DATA GYMNASTICS-Heavy, .056
1530 DATA HANDBALL, .063
1540 DATA HIKING, .042
1550 DATA HILL OR STAIR CLIMBING, .0
     60
1560 DATA HORSEBACK RIDING-Walk, .01
     9
1570 DATA HORSEBACK RIDING-Trot, .04
     6
1580 DATA HORSEBACK RIDING-Gallop, .
     067
1590 DATA IRONING, .018
1600 DATA JUDO, .087
1602 DATA JUMPING ROPE-70 - 80 count
     s/min., .078
1603 DATA KARATE, .087
1605 DATA LACROSSE-Other than goalie
     , .063
1608 DATA LACROSSE-Goalie, .030
1610 DATA LISTENING TO RADIO OR RECO
     RDS, .010
1620 DATA MOTOR BOATING, .016
1630 DATA MOUNTAIN CLIMBING, .086
1632 DATA PAINTING-INSIDE, .015
1634 DATA PAINTING-OUTSIDE, .035
1636 DATA PLAYING CARDS, .011
1638 DATA PLAYING DRUMS, .030
1640 DATA PLAYING HORN, .013
1642 DATA PLAYING PIANO, .018
1646 DATA RACQUETBALL, .063
1650 DATA RESTING-Lying down, .008
1660 DATA RESTING-Sitting, .009
1670 DATA ROWING-Slow-2.5 MPH, .036
1680 DATA ROWING-Vigorous, .118
1690 DATA RUNNING-Level-1 mile in 11
     min., .071
1700 DATA RUNNING-Level-1 mile in 10
      min., .078
1710 DATA RUNNING-Level-1 mile in 9
     min., .085
1720 DATA RUNNING-Level-1 mile in 8
     min., .092
1730 DATA RUNNING-Level-1 mile in 7
     min., .100
1740 DATA RUNNING-Level-1 mile in 6
     min., .110
1750 DATA RUNNING-Level-1 mile in 5
     min., .130
1760 DATA SAILING, .020
1770 DATA SCRUBING, .032
1780 DATA SEWING OR KNITTING, .010
1785 DATA SHOPPING, .028
1790 DATA SHOWERING, .034
1795 DATA SINGING-Standing, .017
1800 DATA SITTING-Quietly, .010
1810 DATA SITTING-WRITING, .013
1820 DATA SKATING-Moderate, .036
1830 DATA SKATING-Vigorous, .064
1840 DATA SKIING-SNOW-Downhill, .059
1850 DATA SKIING-SNOW-Level-slow, .0
     54
1860 DATA SKIING-SNOW-Level-fast, .0
     78
1865 DATA SLEEPING, .007
1870 DATA SOCCER-Other than goalie,
     .063
1880 DATA SOCCER-Goalie, .030
1890 DATA SQUASH, .070
1900 DATA STANDING-Quietly, .011
1920 DATA STATIONARY RUNNING-70 - 80
      counts/min., .078
1930 DATA STUDYING, .014
1940 DATA SWIMMING-CRAWL-30 yds/min.
     , .058
1950 DATA SWIMMING-CRAWL-40 yds/min.
     , .071
1960 DATA SWIMMING-BACKSTROKE-30 yds
     /min., .035
1970 DATA SWIMMING-BACKSTROKE-40 yds
     /min., .055
1980 DATA SWIMMING-BREASTROKE-30 yds
     /min., .048
1990 DATA SWIMMING-BREASTROKE-40 yds
     /min., .064
2000 DATA SWIMMING-BUTTERFLY, .078
2010 DATA TABLE TENNIS-Moderate, .02
     6
2020 DATA TABLE TENNIS-Vigorous, .04
     0
2030 DATA TELEPHONING, .011
2040 DATA TENNIS-SINGLES-Moderate, .
     046
2050 DATA TENNIS-SINGLES-Vigorous, .
     065
2060 DATA TENNIS-DOUBLES-Moderate, .
     038
2070 DATA TENNIS-DOUBLES-Vigorous, .
     046
2080 DATA TYPING, .015
2090 DATA VOLLEYBALL-BEGINNERS-Moder
     ate, .020
2100 DATA VOLLEYBALL-BEGINNERS-Vigor
     ous, .036
2110 DATA VOLLEYBALL-SKILLED-Moderat
     e, .040
2120 DATA VOLLEYBALL-SKILLED-Vigorou
     s, .065
2130 DATA WALKING-LEVEL-2 MPH, .022
2140 DATA WALKING-LEVEL-3 MPH, .030
2150 DATA WALKING-LEVEL-4 MPH, .039
2160 DATA WALKING-LEVEL-5 MPH, .064
2170 DATA WASHING DISHES, .015
2180 DATA WASHING HANDS & FACE, .020
2190 DATA WATCHING TV, .010
2195 DATA WATER SKIING, .053
2200 DATA WEIGHT LIFTING-Arms, .050
2210 DATA WEIGHT LIFTING-Legs, .060
2220 DATA WEIGHT LIFTING-Whole body,
      .065
2230 DATA WRESTLING, .091
2300 DATA END,0,0
```

Program 2:

Calorie Cop (Microsoft Version—Apple, 64, VIC, Color Computer)

```
1 WI = 40:LE = 24
5  HOME
10  PRINT : PRINT : PRINT : PRINT
15  PRINT  TAB( WI / 2 - 5);"CALORIE CO
     P"
30  FOR I = 1 TO 1000: NEXT I
40  HOME
50  PRINT "THIS PROGRAM WILL TELL YOU H
     OW MANY"
55  PRINT : PRINT "CALORIES YOU USE FOR
      A PARTICULAR"
60  PRINT : PRINT "ACTIVITY.  YOU WILL
     BE PROVIDED AN"
65  PRINT : PRINT "ACTIVITY MENU THAT W
     ILL TELL YOU HOW"
70  PRINT : PRINT "MANY CALORIES EACH A
     CTIVITY USES EACH"
75  PRINT : PRINT "MINUTE FOR EACH POUN
```

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Hayden Software Company, 600 Suffolk Street, Lowell, MA 01853

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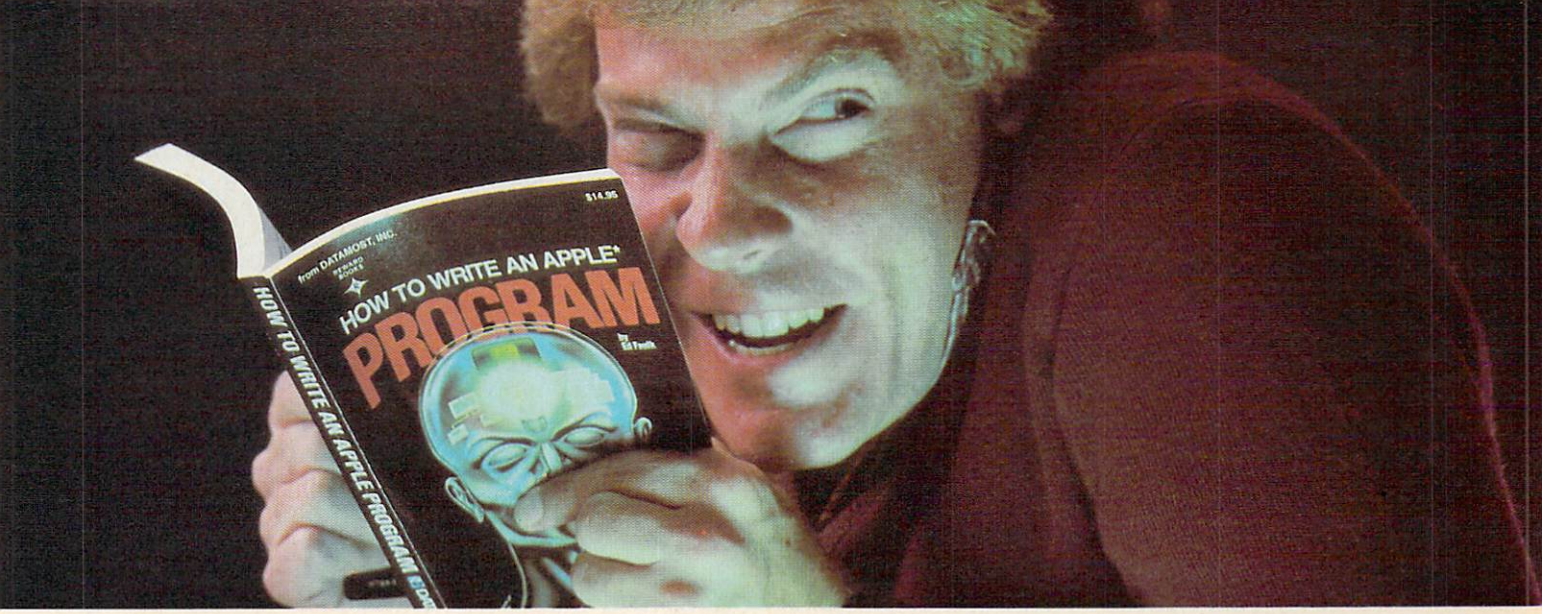
```
    D OF YOUR BODY"
80  PRINT : PRINT "WEIGHT.  IT WILL ALS
    O GIVE YOU A TOTAL"
85  PRINT : PRINT "OF ALL CALORIES USED
    ."
90  PRINT : PRINT "PRESS ANY KEY WHEN F
    INISHED";
95  GET A$
250  IF CAL = 1 THEN 730
260  GOSUB 1020
270  FOR I = 1 TO LE - 4
280  READ ACTIVITY$,CL
290  IF ACTIVITY$ = "END" THEN 330
300  PRINT  CHR$ (64 + I);"-";ACTIVITY$

320  NEXT I
330 I = I - 1
340  PRINT : PRINT "CHOICE ";
350  GET A$
355  IF (A$ < "A" OR A$ >  CHR$ (I + 64
    )) AND A$ <  > "0" AND A$ <  >  CHR$
    (13) THEN 350
360  IF A$ <  >  CHR$ (13) THEN 410
370 NX = NX + 1: IF ACTIVITY$ = "END"
    THEN RESTORE :NX = 0
400  GOTO 260
410  RESTORE
430  IF A$ = "0" THEN 660
440  FOR I = 1 TO NX * (LE - 4) +  ASC
    (A$) - 64
450  READ ACTIVITY$,CL
460  NEXT I
470  HOME
480  PRINT : PRINT "ACTIVITY: ";ACTIVIT
    Y$
490  PRINT : PRINT "THIS ACTIVITY USES:
    ": PRINT CL
500  PRINT "CALORIES PER MINUTE PER"
510  PRINT "POUND"
520  PRINT : PRINT "ENTER LENGTH OF ABO
    VE"
530  PRINT "ACTIVITY IN MINUTES";
540  INPUT MIN
545  IF MIN = 0 THEN 590
547  IF MIN < 0 THEN 540
550  PRINT : PRINT "ENTER YOUR BODY WEI
    GHT"
555  IF MIN < 0 THEN 540
560  PRINT "IN POUNDS";
570  INPUT LBS
572  IF LBS < 0 THEN 570
575 OUTPUT = LBS * MIN * CL
577  PRINT "CALORIES USED FOR THIS"
578  PRINT "ACTIVITY= ";OUTPUT
579  PRINT : PRINT "TOTAL CALORIES USED
    "
580  PRINT "SO FAR= ";:CAL = CAL + OUTP
    UT: PRINT CAL
582  PRINT "PRESS RETURN TO CONTINUE ..
    ."
585  GET A$: IF A$ <  >  CHR$ (13) THEN
    585
590  RESTORE :NX = 0: GOTO 260
660  HOME
665  PRINT : PRINT : PRINT "YOUR TOTAL
    CALORIES": PRINT "ARE ";CAL
670  PRINT : PRINT : PRINT : PRINT "THA
    T'S ALL FOLKS!"
680  FOR PAUSE = 1 TO 1000: NEXT PAUSE
690  END
1020  HOME
1030  PRINT "-=<ACTIVITY MENU>=-"
1035  RETURN
1036  REM  BE SURE TO INCLUDE THE DATA
    STATEMENTS IN PROGRAM 4
```

Program 3:

Calorie Cop (TI-99/4A Version)

```
100 CALL CLEAR
110 PRINT "";TAB(9);"CALORIE COP"
120 PRINT ::::::::::::
180 FOR I=1 TO 1000
190 NEXT I
200 CALL CLEAR
210 PRINT "THIS PROGRAM WILL TELL Y
    OU"
220 PRINT "HOW MANY CALORIES YOU US
    E "
230 PRINT "FOR A PARTICULAR ACTIVIT
    Y."
240 PRINT "YOU WILL BE PROVIDED AN"
250 PRINT "ACTIVITY MENU THAT WILL
    TELL";
260 PRINT "YOU HOW MANY CALORIES EA
    CH"
270 PRINT "ACTIVITY USES EACH MINUT
    E"
280 PRINT "FOR EACH POUND OF YOUR B
    ODY"
290 PRINT "WEIGHT.  IT WILL ALSO GI
    VE"
300 PRINT "YOU A TOTAL OF ALL CALOR
    IES"
310 PRINT "USED."
320 PRINT :::::::
330 PRINT "WAIT FOR MENU TO APPEAR"
340 FOR I=1 TO 5000
350 NEXT I
360 IF CAL=1 THEN 32767
370 GOSUB 970
380 FOR I=1 TO 18
390 READ ACT$,CL
400 IF ACT$="END" THEN 430
410 PRINT CHR$(64+I);"-";ACT$
420 NEXT I
430 REM
440 PRINT "CHOICE :";
450 CALL KEY(0,K,S)
460 IF S=0 THEN 450
470 A$=CHR$(K)
480 IF A$=CHR$(13)THEN 540
490 IF A$="0" THEN 930
500 IF A$<"A" THEN 450
510 IF A$>CHR$(I+63)THEN 450
520 RESTORE
530 GOTO 590
540 NX=NX+1
550 IF ACT$<>"END" THEN 370
560 RESTORE
570 NX=0
580 GOTO 370
590 FOR I=1 TO NX*18+ASC(A$)-64
600 READ ACT$,CL
610 NEXT I
620 CALL CLEAR
630 PRINT :::
640 PRINT "ACTIVITY :";ACT$
650 PRINT ::
660 PRINT "THIS ACTIVITY USES ";CL
```



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Microsoft And TI-99/4A Version Notes For Calorie Cop

Kevin Martin, Editorial Programmer

The Microsoft version of Calorie Cop is written for the Apple and will run on the Commodore 64, VIC-20, and the Color Computer with minor changes.

On the 64 and the VIC, add these lines:

```
5 PRINT "{CLR}"
40 PRINT "{CLR}"
95 GETA$:IFA$=""THEN95
350 GETA$:IFA$=""THEN350
585 GETA$:IFA$<>CHR$(13)THEN585
660 PRINT "{CLR}"
1020 PRINT "{CLR}"
```

On the Color Computer:

```
5 CLS
40 CLS
95 IF INKEY$="" THEN 95
350 A$=INKEY$:IF A$="" THEN 350
585 IF INKEY$<>CHR$(13) THEN 585
660 CLS
1020 CLS
```

The instructions for the program are formatted for a 40-column screen. For the 64, VIC, and Color Computer, substitute the following lines so that the instructions fit on your screen, or you may simply leave these lines out. If you leave them out, then also remove line 95.

For the 64, change line 1 to:

```
1 WI=40:LE=25
```

For the VIC, change line 1 to:

```
1 WI=22:LE=23
```

For the Color Computer, change line 1 to:

```
1 WI=32:LE=16
```

To exit the program type a 0 when you are prompted for CHOICE. Before ENDing, the program will tell you the total number of calories used.

Be sure to type in Program 4 along with either the Microsoft or TI-99/4A version. This program contains the necessary DATA statements for both of these versions.

```
670 PRINT "CALORIES PER MINUTE PER"
680 PRINT "POUND"
690 PRINT :::
700 PRINT "IF YOU ENTERED THE WRONG
    "
710 PRINT "ACTIVITY TYPE IN ZEROS B
    ELOW"
720 PRINT
730 PRINT "ENTER LENGTH OF ACTIVITY
     IN"
740 INPUT "MINUTES:":MIN
750 IF MIN=0 THEN 800
760 PRINT
770 PRINT "INPUT YOU BODY WEIGHT IN
     "
780 INPUT "POUNDS:":LBS
790 OUT=LBS*MIN*CL
800 PRINT "CALORIES FOR THIS ACTIVI
    TY "
810 PRINT "EQUALS ";OUT
820 PRINT
830 PRINT "TOTAL CALORIES USED SO F
    AR"
840 CAL=CAL+OUT
850 PRINT "IS ";CAL
860 PRINT ::
870 PRINT "PRESS ANY KEY TO CONTINU
    E.."
880 CALL KEY(0,K,S)
890 IF S=0 THEN 880
900 RESTORE
910 NX=0
920 GOTO 370
930 CALL CLEAR
940 PRINT "TOTAL CALORIES =";CAL
950 PRINT "BYE!"
960 END
970 CALL CLEAR
980 PRINT " --==<<ACTIVITY MENU>>==
    -- "
990 RETURN
1000 REM  BE SURE TO INCLUDE THE DAT
     A STATEMENTS IN PROGRAM 4
```

Program 4:

Calorie Cop (DATA Statements For Programs 2 And 3)

```
1040  DATA  ARCHERY,.034
1050  DATA  BADMINTON-MODERATE,.039
1060  DATA  BADMINTON-VIGOROUS,.065
1070  DATA  BASEBALL,.031
1080  DATA  BASEBALL-PITCH&CATCH,.040
1090  DATA  BASKETBALL-MODERATE,.047
1100  DATA  BASKETBALL-VIGOROUS,.066
1110  DATA  BED MAKING,.031
1120  DATA  BICYCLING-DOWNHILL,.018
1130  DATA  BICYCLING-SLOW-LEVEL,.030
```

```
1140 DATA BICYCLING-MODERATE,.050
1150 DATA BICYCLE-FAST-UPHILL,.072
1160 DATA BOXING-IN RING,.101
1170 DATA BOXING-SPARING,.063
1180 DATA BOWLING,.028
1190 DATA CANOEING,.029
1200 DATA CONVERSING,.011
1210 DATA COOKING,.013
1220 DATA DANCING-SLOW,.029
1230 DATA DANCING-MODERATE,.045
1240 DATA DANCING-FAST,.064
1250 DATA DRESSING&UNDRESSING,.030
1260 DATA DRIVING A CAR,.019
1270 DATA DUSTING,.010
1280 DATA EATING,.011
1290 DATA EXERCISES-ABDOMINAL,.020
1300 DATA EXERCISES-BALANCING,.016
1310 DATA EXERCISES-JUMPING,.043
1320 DATA EXERCISES-BENDING,.023
1330 DATA FENCING-MODERATE,.033
1340 DATA FENCING-VIGOROUS,.057
1350 DATA FIELD HOCKEY,.063
1360 DATA FIELD HOCKEY-GOALIE,.030
1370 DATA FISHING,.016
1380 DATA FOOTBALL-BACKS&ENDS,.050
1390 DATA FOOTBALL-LINEMEN,.040
1400 DATA GARDENING,.030
1410 DATA GOLF-CROWDED&WALKING,.030
1420 DATA GOLF-UNCROWDED&WALK,.035
1430 DATA GYMNASTICS-LIGHT,.030
1440 DATA GYMNASTICS-HEAVY,.056
1450 DATA HANDBALL,063
1460 DATA HIKING,.042
1470 DATA HILL&STAIR CLIMBING,.060
1480 DATA HORSEBACK RIDE-WALK,.019
1490 DATA HORSEBACK RIDE-TROT,.046
1500 DATA HORSEBACK -GALLOP,.067
1510 DATA IRONING,.018
1520 DATA JUDO,.087
1530 DATA JUMPING ROPE,.087
1540 DATA KARATE,.087
1550 DATA LACROSSE,.063
1560 DATA LACROSSE-GOALIE,.030
1570 DATA LISTENING TO RADIO,.010
1580 DATA MOTOR BOATING,.016
1590 DATA MOUNTAIN CLIMBING,.086
1600 DATA PAINTING-INSIDE,.015
1610 DATA PAINTING-OUTSIDE,.035
1620 DATA PLAYING CARDS,.011
1630 DATA PLAYING DRUMS,.030
1640 DATA PLAYING HORN,.013
1650 DATA PLAYING PIANO,.018
1660 DATA RACQUETBALL,.063
1670 DATA RESTING-LYING DOWN,.008
1680 DATA RESTING-SITTING,.009
1690 DATA ROWING-SLOW,.036
1700 DATA ROWING-VIGOROUS,.118
1710 DATA RUNNING-11 MIN./MILE,.071
1720 DATA RUNNING-10 MIN./MILE,.078
1730 DATA RUNNING-9 MIN./MILE,.085
1740 DATA RUNNING-8 MIN./MILE,.092
1750 DATA RUNNING-7 MIN./MILE,.100
1760 DATA RUNNING-6 MIN./MILE,.110
1770 DATA RUNNING-5 MIN./MILE,.130
1780 DATA SAILING,.020
1790 DATA SCRUBING,.032
1800 DATA SEWING OR KNITTING,.010
1810 DATA SHOPPING,.028
1820 DATA SHOWERING,.034
1830 DATA SINGING-STANDING,.017
1840 DATA SITTING-QUIETLY,.010
1850 DATA SITTING-WRITING,.013
1860 DATA SKATING-MODERATE,.036
1870 DATA SKATING-VIGOROUS,.064
1880 DATA SKIING-DOWNHILL,.059
1890 DATA SKIING-LEVEL-SLOW,.054
1900 DATA SKIING-LEVEL-FAST,.078
1910 DATA SLEEPING,.007
1920 DATA SOCCER,.063
1930 DATA SOCCER-GOALIE,.030
1940 DATA SQUASH,.070
1950 DATA STANDING,.011
1960 DATA STATIONARY RUNNING,.078
1970 DATA STUDYING,.014
1980 DATA SWIM-CRAWL-30YDS/MIN,.058
1990 DATA SWIM-CRAWL-40YDS/MIN,.071
2000 DATA SWIM-BKSTRK-30YDS/MN,.035
2010 DATA SWIM-BKSTRK-40YDS/MN,.055
2020 DATA SWIM-BREAST-30YDS/MN,.048
2030 DATA SWIM-BREAST-40YDS/MN,.064
2040 DATA SWIM-BUTTERFLY,.078
2050 DATA TABLE TENNIS-MOD.,.026
2060 DATA TABLE TENNIS-VIG.,.040
2070 DATA TELEPHONING,.011
2080 DATA TENNIS-SNGLS-MOD.,.046
2090 DATA TENNIS-SNGLS-VIG.,.065
2100 DATA TENNIS-DBLES-MOD.,.038
2110 DATA TENNIS-DBLES-VIG.,.046
2120 DATA TYPING,.015
2130 DATA VOLLEYBALL-BEG.-MOD.,.020
2140 DATA VOLLEYBALL-BEG.-VIG.,.036
2150 DATA VOLLEYBALL-SKILL-MOD,.040
2160 DATA VOLLEYBALL-SKILL-VIG,.065
2170 DATA WALKING-2 MPH,.022
2180 DATA WALKING-3 MPH,.030
2190 DATA WALKING-4 MPH,.039
2200 DATA WALKING-5 MPH,.064
2210 DATA WASHING DISHES,.015
2220 DATA WASHING HANDS & FACE,.020
2230 DATA WATCHING TV,.010
2240 DATA WATER SKIING,.053
2250 DATA WEIGHT LIFTING-ARMS,.050
2260 DATA WEIGHT LIFTING-LEGS,.060
2270 DATA WEIGHT LIFTING-BODY,.065
2280 DATA WRESTLING,.091
2290 DATA END,0,0
```

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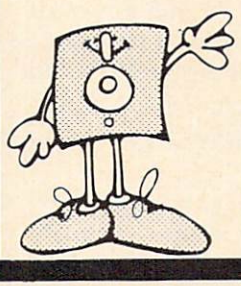

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Paycheck Analysis

Larry L. Bihlmeyer

This short program analyzes your paycheck for accuracy and lets you project future take-home pay so you can budget accordingly. Also included is a variable table for easy and personalized modification. For the VIC, 64, PET, Atari, TI, Apple, Color Computer, and Timex/Sinclair.

Here's a handy program that can help you do two important jobs: verify the accuracy of your take-home pay; and estimate your take-home pay in the future so you can do accurate budget studies. This is especially helpful since federal, state, and Social Security taxes are constantly changing. The program can easily be modified so you can adapt it to your situation. Here's how:

• The program is set up for two pay periods a month. If your pay periods are different, change the wording and revise the tax table values used in lines 620 to 840. You can get the necessary information from your payroll department. Also, as withholding rates change in the future, just update these lines accordingly.

• Cost of living pay is set up as a separate variable. It is taxed at a fixed 20 percent rate where I work. If your cost of living is taxed the same as regular pay, change (B + A) to TS in line 600 and change line 850 to F = TX.

• Overtime pay is included (lines 280 – 290) as a separate variable since it may be at a different hourly rate and may vary with each pay period.

• Deductions are found on lines 340 to 590. Just modify them if appropriate. Make sure to change line 860 if you use different variable names.

"Paycheck Analysis" will run on the VIC, 64, PET, Atari, TI, Apple, Color Computer, and Timex/Sinclair. Atari owners *only*: you must include line 110. Timex/Sinclair users must use LET before any assignment statements (for example, at line 320, type LET A = R*N).

Program Variables

Variable	Description
B	Base salary (gross)
C	Cost of living (gross)
A	Overtime (gross)
R	Overtime hourly rate
N	Overtime hours worked
TS	Total salary (gross)
EX	Number of federal exemptions claimed
P$	Pay period(s)
U	Deduction — United Fund
T	Stock plan deduction
D	Payroll deduction — credit union
S	Social Security tax (FICA)
M	State tax withholding
IN	Income subject to federal tax
TX	Federal tax withheld
F	Total federal tax
TH	Take-home pay
I	Life insurance deduction

Paycheck Analysis

```
100 REM USE LINE 110 ONLY ON ATARI
110 DIM A$(1),B$(1),P$(1)
120 PRINT"{CLR}"
130 REM SUBSTITUTE COMMAND IN LINE 120 TO
    CLEAR THE SCREEN ON YOUR COMPUTER
140 PRINT "----PAYCHECK ANALYSIS----"
150 PRINT "{3 SPACES}(6.92% STATE TAX)
    {3 SPACES}"
160 PRINT
170 PRINT
180 PRINT
190 PRINT "BASE SALARY? (GROSS-SEMIMONTHL
    Y)"
200 INPUT B
210 PRINT "COST OF LIVING (GROSS)?"
220 INPUT C
230 PRINT
```

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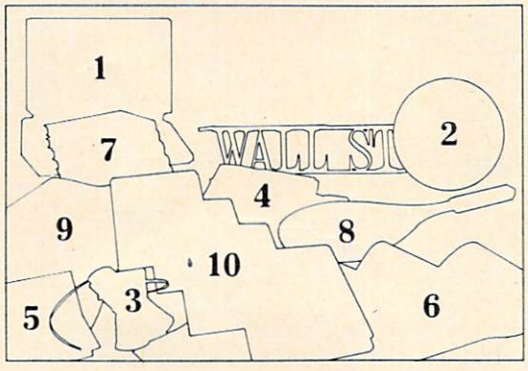

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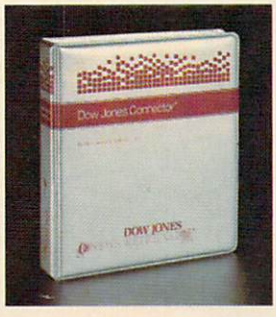

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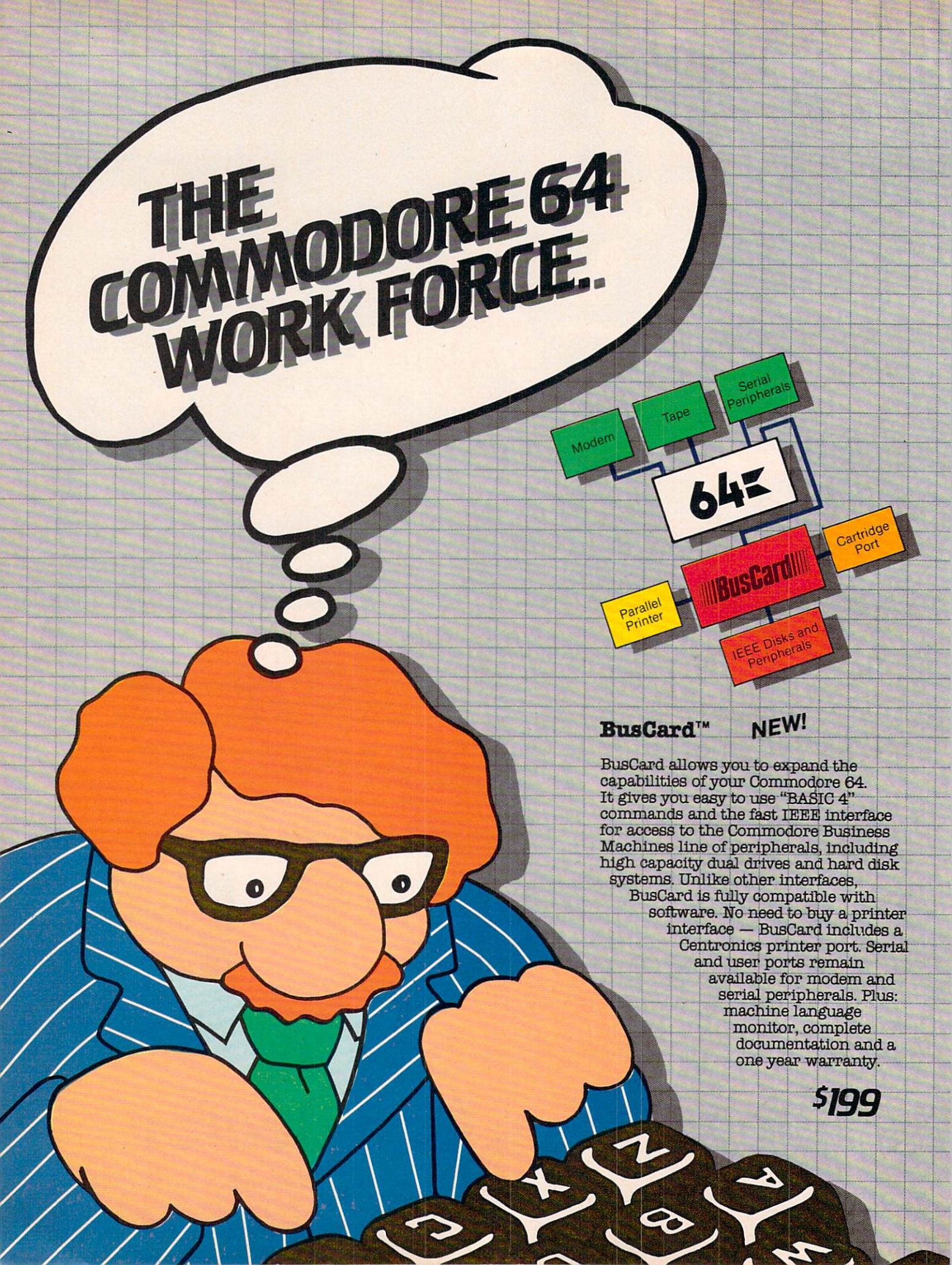

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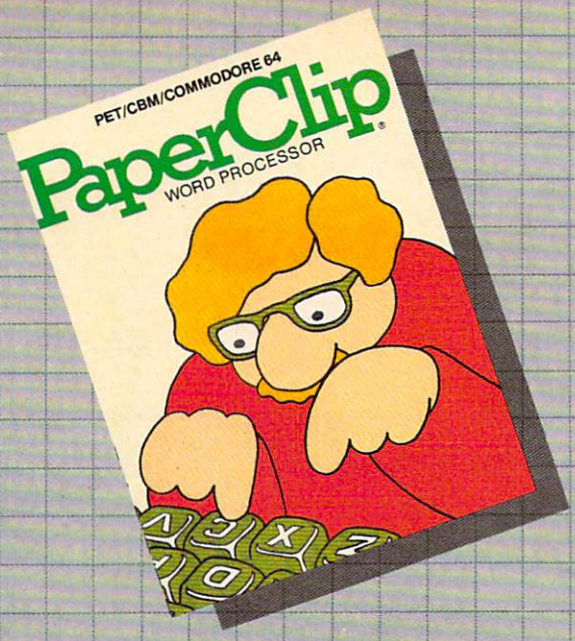

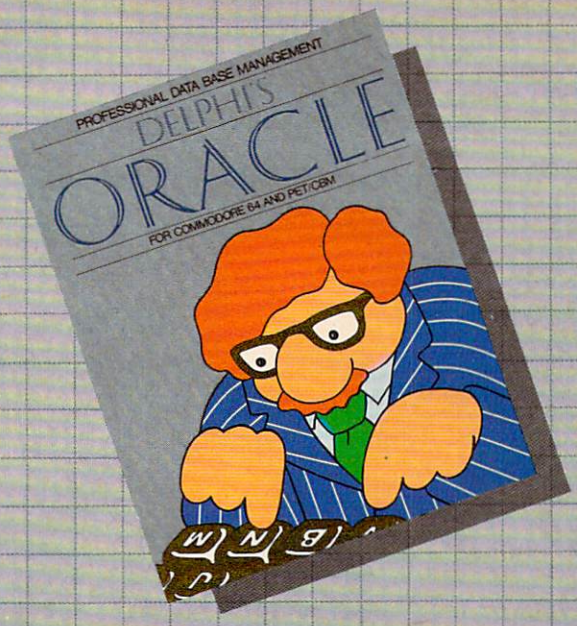

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```
240 PRINT "ANY OVERTIME?{SHIFT-SPACE}(Y/N
    )"
250 INPUT A$
260 IF (A$<>"N")*(A$<>"Y") THEN 250
270 IF A$="N" THEN 340
280 PRINT "HOURLY OVERTIME RATE (GROSS)"
290 INPUT R
300 PRINT "NUMBER OF OVERTIME HOURS"
310 INPUT N
320 A=R*N
330 GOTO 360
340 A=0
350 REM GROSS SALARY W/ OVERTIME IN LINE
    {SPACE}310
360 TS=B+C+A
370 PRINT "NUMBER OF FED EXEM CLAIMED:"
380 INPUT EX
390 REM DEDUCTIONS
400 PRINT
410 PRINT
420 PRINT "PAY PERIOD-MIDDLE(M) OR END(E)
    :"
430 INPUT P$
440 IF (P$<>"E")*(P$<>"M") THEN 430
450 IF P$="E" THEN 490
460 I=13.50
470 REM  I IS INSURANCE DED ONCE A MONTH
480 GOTO 500
490 I=0
500 U=10.00
510 REM U IS UNITED FUND
520 T=0
530 REM T IS STOCK PLAN
540 D=100.00
550 REM D IS CREDIT UNION PAYROLL DED
560 S=.067*TS
570 REM S IS FICA
580 M=(.0692*TS)-12.97
590 REM M IS STATE TAX
600 IN=(B+A)-41.66*EX
610 REM EX IS FEDERAL EXEM AND-IN IS TAXA
    BLE INCOME
620 REM FED WITHHOLDING TABLE (MARRIED, P
    AID SEMIMONTHLY)
630 IF IN>100 THEN 660
640 TX=0
650 GOTO 850
660 IF IN>253 THEN 690
670 TX=.12*(IN-100)
680 GOTO 850
690 IF IN>499 THEN 720
700 TX=18.36+.16*(IN-253)
710 GOTO 850
720 IF IN>772 THEN 750
730 TX=57.72+.19*(IN-499)
740 GOTO 850
750 IF IN>983 THEN 780
760 TX=109.50+.24*(IN-772)
770 GOTO 850
780 IF IN>1204 THEN 810
790 TX=160.23+.27*(IN-983)
800 GOTO 850
810 IF IN>1425 THEN 840
820 TX=219.90+.32*(IN-1204)
830 GOTO 850
840 TX=290.62+.37*(IN-1425)
850 F=TX+(.20*C)
860 TH=(B+C+A)-(F+M+S+I+U+T+D)
870 PRINT
880 PRINT
890 PRINT "TAKE HOME PAY IS $";INT(TH*100
    +.5)/100
900 PRINT
910 PRINT
920 PRINT "DO ANOTHER ANALYSIS?"
930 INPUT B$
940 IF B$="Y" THEN 120
950 END
```

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Utility Bill Audit

Larry L. Bihlmeyer

As utility bills continue to rise, it's a good idea to check them for accuracy. Here's a practical program enabling you to verify your electric, gas, water, and phone bills. Written for all Commodores, TI, Apple, and Color Computer, an Atari version is also included.

"Utility Bill Audit" is a versatile program that lets you check your electric, gas, water, and phone bills for accuracy, or split the costs of these bills among the people living in your household. Also, if you are interested in energy savings (and who isn't these days?), you can monitor your daily electric and gas consumption with this program.

Program 1 will run on all Commodore machines, TI, Apple, and Color Computer. One minor modification, however, is required if you have a TI-99/4A, Apple, or Color Computer. Line 200 contains a statement to clear the screen and cursor home. Substitute the appropriate command for your machine in this line (CALL CLEAR for TI, HOME for Apple, CLS for the Color Computer).

Personalizing The Program

Before you RUN this program, it is necessary to have a thorough understanding of how each bill is calculated in the program. First, a particular bill is split up according to the values (2,1,2,4) given in the DATA statement in line 1640. These values are assigned to the variable N(X) and represent the number of individuals who must pay for each bill. In its present form, the program assumes that the electric and water bills will be paid by two individuals, the phone bill by four, and the gas bill by one individual. However, it's unlikely that these numbers will correspond to the financial arrangements in your household. So, be sure to substitute the appropriate values in this line before you continue. Of course, if the bills are paid by one individual in the house, simply replace all four numbers in line 1640 with 1,1,1,1.

Since the program works on the actual costs of your utility bills based on local rates, certain information about these rates must be provided before you can run the program. This information is READ in line 380 and 400 from the DATA statements in lines 1650 – 1680.

Notice that the first three DATA statements in this sequence have nine entries and apply to the electric, gas, and water bills respectively. Let's consider line 1650 as an example. The first entry in this line is the name of the utility (ELECTRIC) for which the rates that follow apply. The second entry is the unit of measurement for that particular utility (KWH for kilowatt hours). The next entry is the minimum service charge for the utility ($5.40 for electricity). The fourth entry is the tax rate based on the sum of the service charge and the

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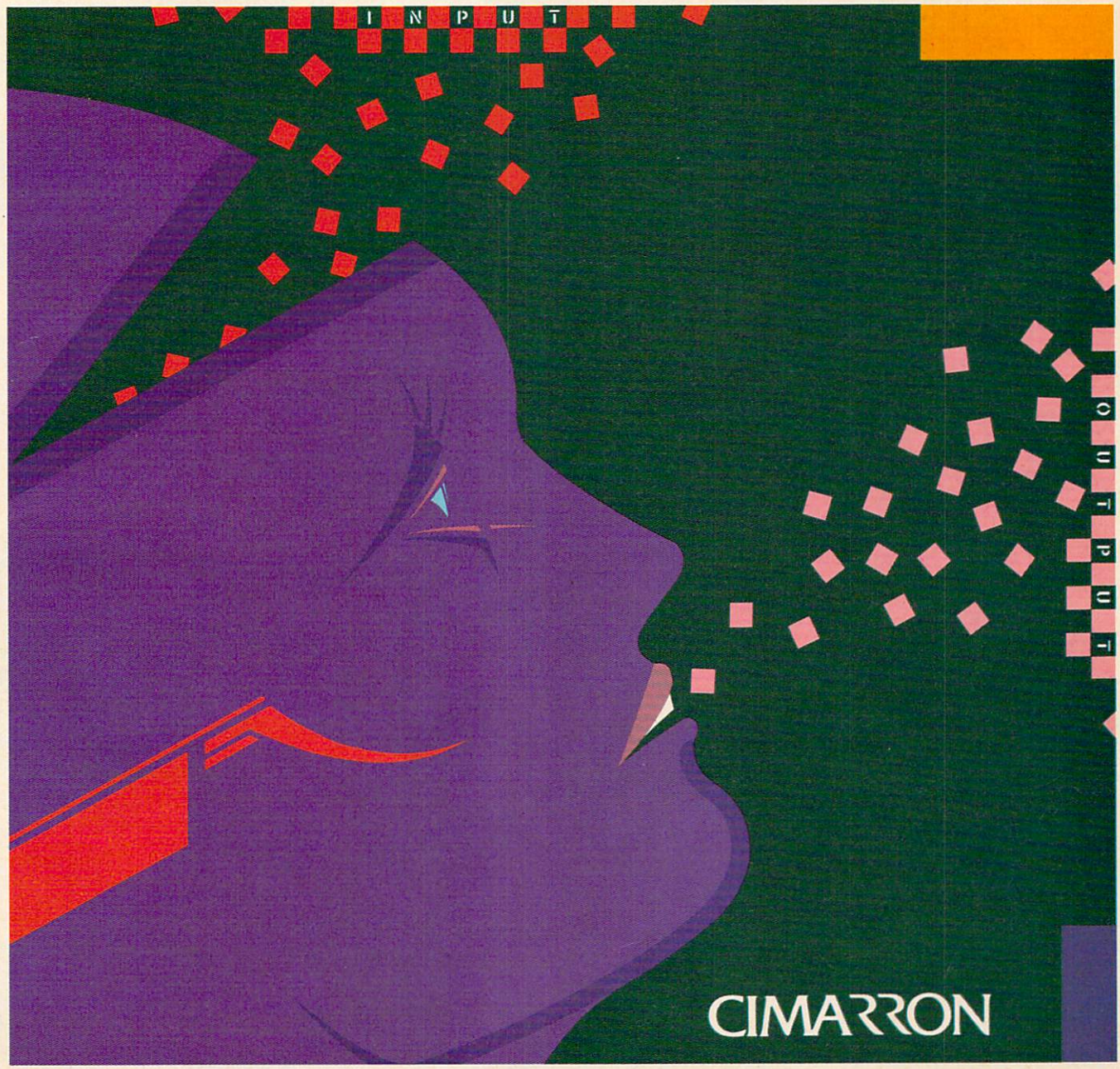

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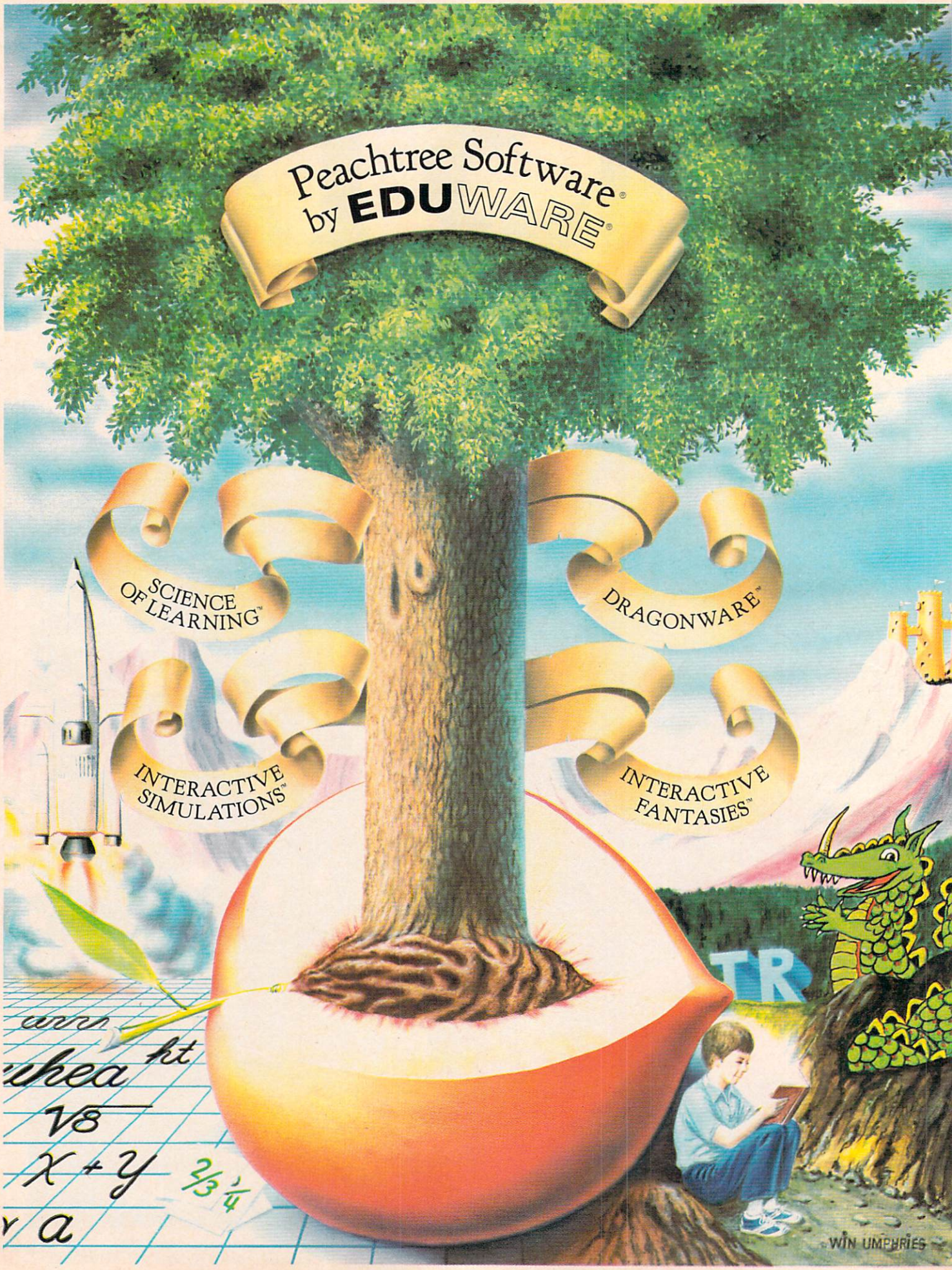
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rate charge (0 percent for electric use). These first four DATA entries are READ in as A$(1), B$(1), M(1), and Z(1), respectively.

At this point, the numbers begin to get a little confusing, so read carefully. The next two numbers are cutoff limits for each electric rate and are represented in the program by L1(1) and L2(1). The last three numbers are the actual rates charged per KWH use for each level of usage (R1(1), R2(1), and R3(1) in the program). Thus, the program is presently set up so that the rate charged for electricity is $.0495 for the first 350 KWH, $.0565 for the next 950 KWH (i.e., 1300 minus 350), and $.0541 for any usage exceeding 1300 KWH.

The DATA statement in line 1680 is easier to follow: the utility (PHONE), the minimum service charge ($13.50), and the tax rate on the service charge and long distance calls (3 percent).

So, get out your most recent bills and read off the various rates (per KWH for electric, per CCF or hundred cubic feet for gas and water). If the rates are not given on a bill, contact the utility company to get a schedule of the latest rates. Then just substitute your local rates for those in the DATA statements in lines 1650 to 1680.

Program Operation

After inserting the correct rates, RUN the program. You will then be asked which utility bill you wish to check. The first three menu choices are electric, gas, and water. Bills for these three utilities are all calculated in the routine beginning at line 560. Let s look at an electric bill as an example.

When the routine at line 560 is executed, you will be required to INPUT the present and previous meter readings. These values can be read directly from your latest electric bill. Next, you must INPUT the number of days in the billing period. Then you will be asked to INPUT any adjustments to the bill, either positive (for example, connection fees, previous balances) or negative (credits).

The program will next calculate the amount of electricity consumed for the given period (defined as U in line 720). Then, depending on the value of U relative to the two rate limits, L1(1) and L2(X) (lines 740 and 750), an amount owed (T) before tax and adjustments will be calculated (lines 760, 780, and 800). Next, the tax on this amount will be determined (T1). And finally a total electric bill — the sum of the minimum charge, usage cost, tax, and adjustments — will be calculated (T3) in line 830.

The results are then PRINTed on the screen with provisions for formatting the output to two places past the decimal. Any numbers in the third place past the decimal are simply dropped. If you prefer rounded numbers, you could easily modify the program to achieve that.

The routine beginning at line 560, as mentioned, also calculates the gas and water bills. These are based on the rates READ from the DATA statements in lines 1660 and 1670. Notice the sets of large numbers (precisely, 99999) in line 1660. The rates for gas where I live are the same, regardless of the amount used. By using large numbers here for the cutoff limits, L1(2) and L2(2), for this utility, it's unlikely that the actual usage will exceed these amounts (see lines 740 and 750). Thus, the charge for this commodity will always be based on the first rate, or R1.

The rates for water, as READ from the DATA statement in line 1670, are based on a single cutoff limit (L1(3)) of 1000 CCF. For less than this, a usage rate (R1(3)) of $.144 per CCF is charged. If water usage exceeds 1000 CCF, a second rate (R2(3)) of $.160 is charged. Again, using a very large number (99999) for the second cutoff limit (L2(3)) assures that the overall usage cost is based only on two rates.

Analyzing The Phone Bill

Phone bills are checked in a separate routine in the program beginning at line 1110. In this routine, adjustments to the bill are initially INPUT in the same manner as they are with the electric, gas, and water bills. Next, the person responsible for each long distance charge is required to INPUT the amount of each long distance call. A separate routine (lines 1260 – 1360) allows the individual to correct any typing mistakes. Finally, the amount owed by one individual is displayed.

The portion of the phone bill that each person must pay is the sum of their long distance tolls, a proportional amount of both the service charge and the billing adjustments, and a proportional amount of the tax levied on the service and long distance calls. Again, if only one person in the household foots the bills, the last number in line 1640 should be 1.

In addition to enabling you to catch billing errors and helping you to easily divide up household bills, this program can help you monitor your costs. If you add an energy-saving device that is supposed to save, say, 10 percent of your total electric bill, take a meter reading when it is installed and verify the savings with a later reading. You can also project weekly, monthly, and yearly savings for any utility in this manner.

Program 1: Microsoft & TI Version (Commodore, TI, Apple, Color Computer)

```
100 GOTO 330
110 A1=0
120 PRINT"INPUT ADJUSTMENTS TO BILL(+ OR
    {SPACE}- ,'0' WHEN DONE)"
130 INPUT A
140 A1=A1+A
```

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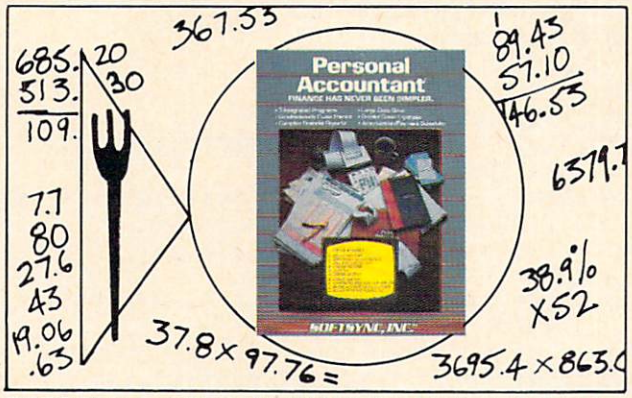

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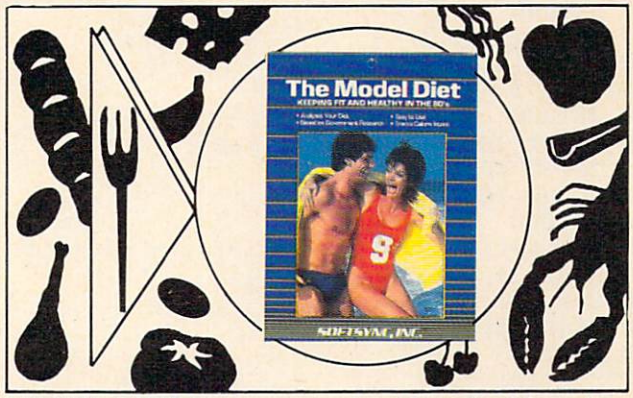

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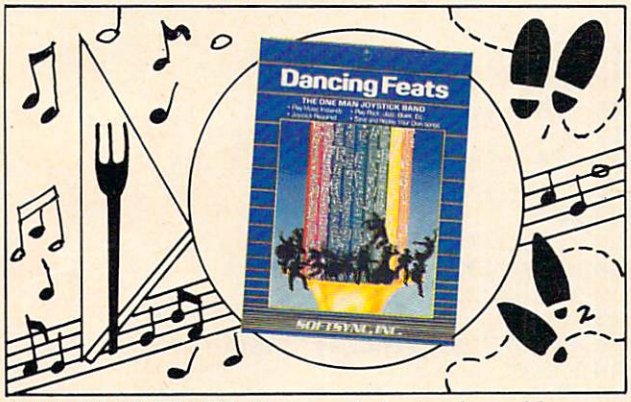

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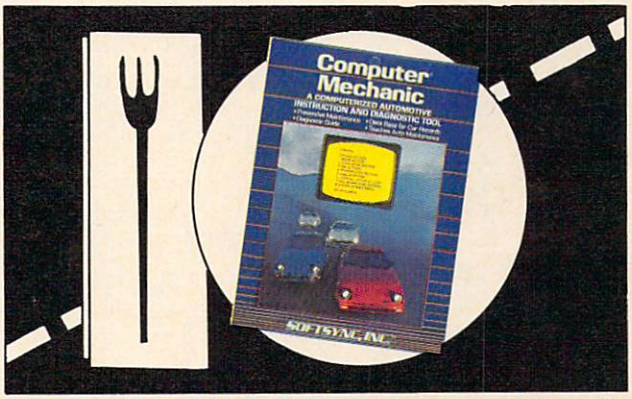

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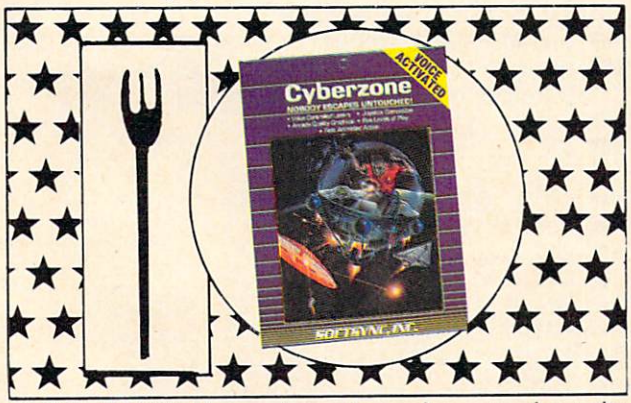

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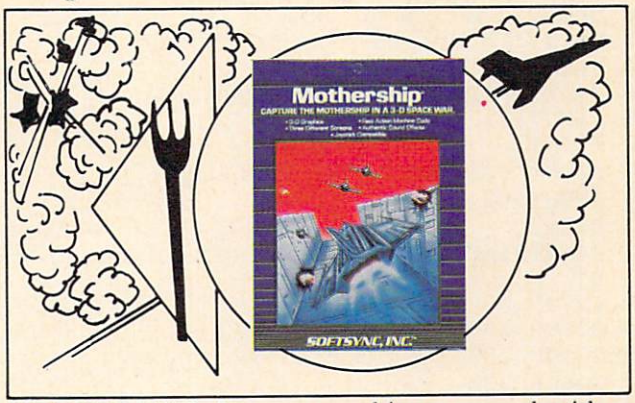

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```
150 IF A=0 THEN 170
160 GOTO 130
170 GOSUB 250
180 GOSUB 290
190 RETURN
200 PRINT"{CLR}"
210 RETURN
220 PRINT "{2 SPACES}";A$(X);" BILL(CONT'
    )"
230 PRINT
240 RETURN
250 FOR I=1 TO 3
260 PRINT
270 NEXT I
280 RETURN
290 PRINT"INPUT C TO CONTINUE";
300 INPUT C$
310 GOSUB 200
320 RETURN
330 DIM A$(4),B$(4),L1(3),L2(3),M(4),R1(3
    ),R2(3),R3(3),W(50),Z(4)
340 FOR I=1 TO 4
350 READ N(I)
360 NEXT I
370 FOR I=1 TO 3
380 READ A$(I),B$(I),M(I),Z(I),L1(I),L2(I
    ),R1(I),R2(I),R3(I)
390 NEXT I
400 READ A$(4),M(4),Z(4)
410 GOSUB 200
420 PRINT"{2 SPACES}UTILITY BILL AUDIT"
430 GOSUB 250
440 PRINT" 1. ELECTRIC BILL"
450 PRINT" 2. GAS BILL"
460 PRINT" 3. WATER BILL"
470 PRINT" 4. PHONE BILL"
480 PRINT" 5. ALL OF THE ABOVE"
490 PRINT" 6. EXIT"
500 PRINT
510 PRINT
520 PRINT" CHOOSE AN OPTION ";
530 INPUT P
540 IF (P<1)+(P>6) THEN 530
550 ON P GOTO 1020,1050,1080,1110,1590,16
    90
560 GOSUB 200
570 PRINT"{4 SPACES}";A$(X);" BILL"
580 PRINT
590 PRINT"PREVIOUS METER READING"
600 INPUT E1
610 PRINT
620 PRINT"PRESENT METER READING"
630 INPUT E2
640 PRINT
650 PRINT"INPUT DAYS IN THE BILLING PERIO
    D"
660 INPUT D
670 GOSUB 250
680 GOSUB 290
690 GOSUB 200
700 GOSUB 220
710 GOSUB 110
720 U=E2-E1
730 Y=U/D
740 IF U>L2(X) THEN 800
750 IF U>L1(X) THEN 780
760 T=M(X)+R1(X)*U
770 GOTO 810
780 T=M(X)+R1(X)*L1(X)+R2(X)*(U-L1(X))
790 GOTO 810
800 T=M(X)+R1(X)*L1(X)+R2(X)*(L2(X)-L1(X)
    )+R3*(U-L2(X))
810 T1=T*Z(X)
820 T2=T+T1
830 T3=T2+A1
840 GOSUB 200
850 GOSUB 220
860 PRINT "USE FOR THE PERIOD IS ";INT(U*
    100)/100;" ";B$(X)
870 PRINT
880 PRINT "USE/DAY IS ";INT(Y*100)/100;"
    {SPACE}";B$(X);" OR $";
890 PRINT INT(T2/D*100)/100;"/DAY INCLUDI
    NG TAX"
900 PRINT
910 PRINT A$(X);" BILL:"
920 PRINT " W/OUT TAX{2 SPACES}:$";INT(T*
    100)/100
930 PRINT " TAX IS{5 SPACES}:$";INT(T1*10
    0)/100
940 PRINT" ADJ'TS{5 SPACES}:$";A1
950 PRINT
960 PRINT "{2 SPACES}*TOTAL*{3 SPACES}:$"
    ;INT(T3*100)/100
970 IF N(X)=1 THEN 990
980 PRINT"SPLIT ";N(X);" WAYS:$";INT(T3/N
    (X)*100)/100
990 PRINT
1000 GOSUB 290
1010 RETURN
1020 X=1
1030 GOSUB 560
1040 GOTO 430
1050 X=2
1060 GOSUB 560
1070 GOTO 430
1080 X=3
1090 GOSUB 560
1100 GOTO 430
1110 GOSUB 200
1120 X=4
1130 PRINT "{5 SPACES}";A$(X);" BILL"
1140 PRINT
1150 GOSUB 110
1160 FOR K=1 TO N(X)
1170 I=1
1180 IF N(X)=1 THEN 1200
1190 PRINT"FOR PERSON #";K;",";
1200 PRINT "INPUT CHARGE FOR EACH LONG DI
     STANCE CALL (INPUT '0' WHEN DONE)"
1210 INPUT W(I)
1220 IF W(I)=0 THEN 1250
1230 I=I+1
1240 GOTO 1210
1250 GOSUB 200
1260 PRINT" PERSON #";K;",";
1270 FOR J=1 TO I-1
1280 PRINT "CALL #";J;"{2 SPACES}:$";W(J)
1290 PRINT
1300 PRINT "IS THIS CORRECT (Y/N)"
1310 INPUT C$
1320 IF C$="Y" THEN 1350
1330 PRINT "TYPE IN CORRECTION"
1340 INPUT W(J)
1350 PRINT
1360 NEXT J
1370 GOSUB 200
1380 GOSUB 220
1390 T=0
1400 FOR J=1 TO I-1
1410 T=T+W(J)
1420 NEXT J
```

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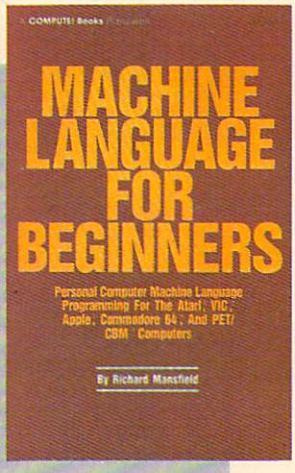

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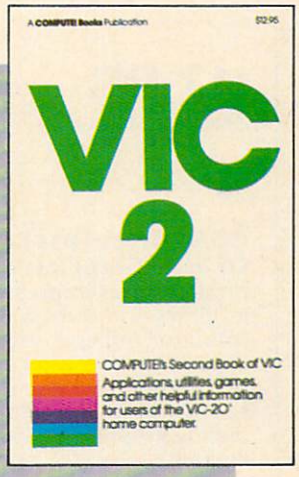

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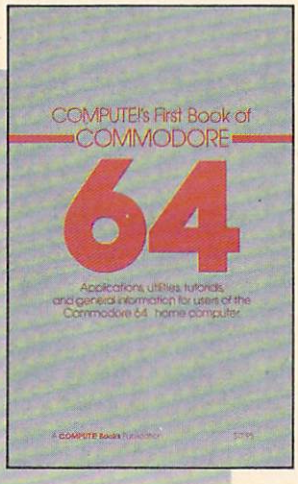

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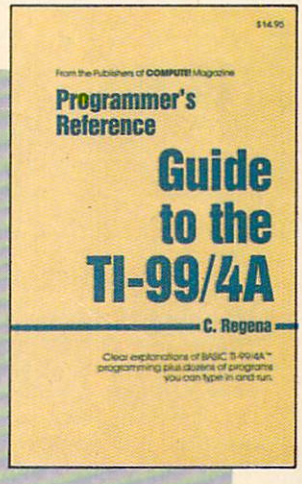

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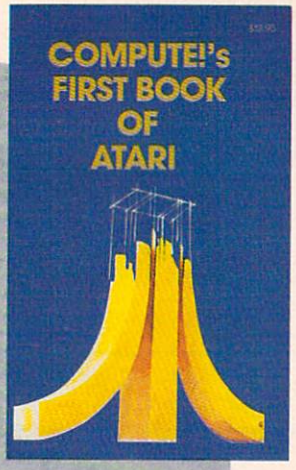

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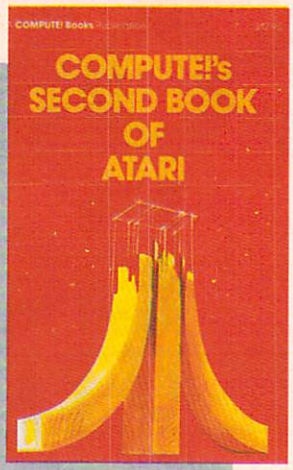

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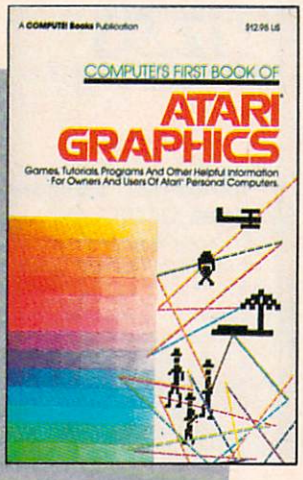

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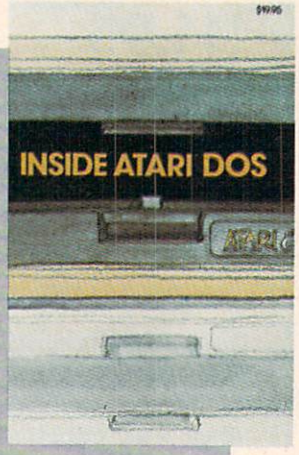

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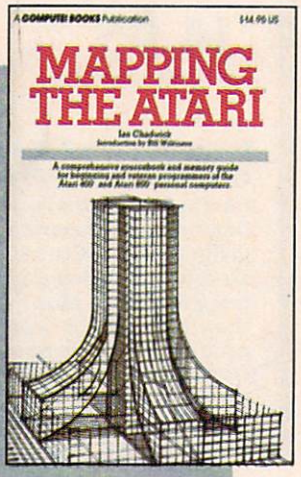

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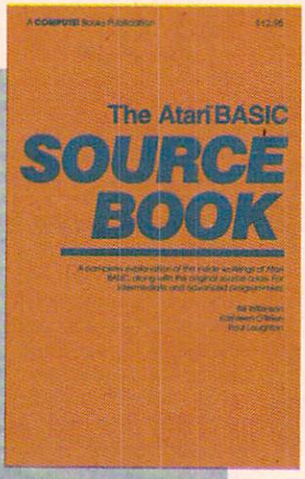

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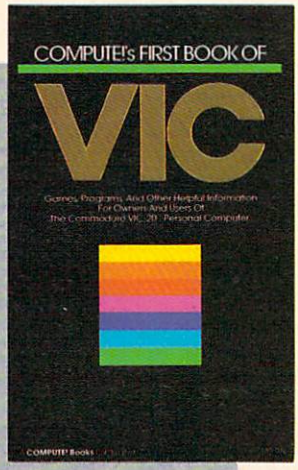

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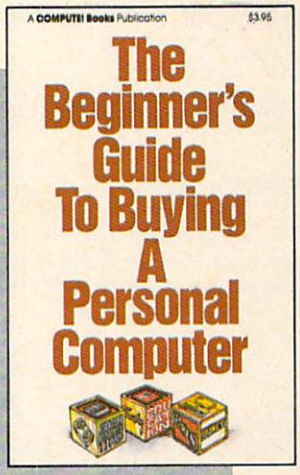

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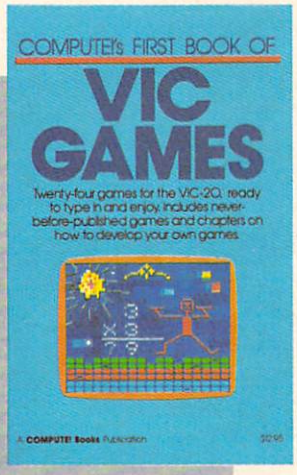

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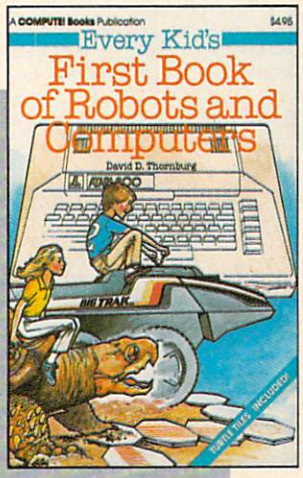

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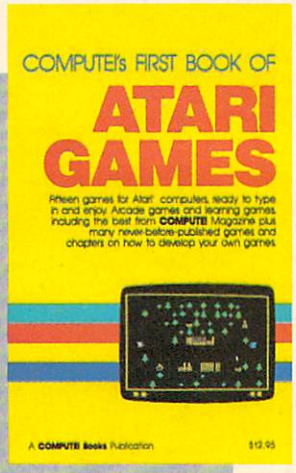

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```
1430 PRINT "SERVICE:{3 SPACES}$";INT(M(X)
     /N(X)*100)/100
1440 PRINT
1450 PRINT "LD CALLS:{2 SPACES}$";T
1460 PRINT
1470 PRINT"ADJ'TS :{3 SPACES}$";INT(A1/N(
     X)*100)/100
1480 PRINT
1490 T1=T+INT(M(X)/N(X)*100)/100
1500 T2=INT(T1*Z(X)*100)/100
1510 PRINT "TOTAL TAX: $";T2
1520 PRINT
1530 PRINT
1540 PRINT " TOTAL BILL: $";T1+T2+INT(A1/
     N(X)*100)/100
1550 GOSUB 250
1560 GOSUB 290
1570 NEXT K
1580 GOTO 430
1590 FOR F=1 TO 3
1600 X=F
1610 GOSUB 560
1620 NEXT F
1630 GOTO 1110
1640 DATA 2,1,2,4
1650 DATA ELECTRIC,KWH,5.40,0,350,1300,.0
     495,.0565,.0541
1660 DATA GAS,CCF,4.05,0,99999,99999,.495
     41,0,0
1670 DATA WATER,CCF,3.26,0,500,99999,.144
     ,.160,0
1680 DATA PHONE,13.50,.03
1690 END
```

Program 2: Atari Version

```
100 GOTO 200
110 A1=0:PRINT "INPUT BILLING ADJUST
    MENTS (+ OR -,'0' WHEN DONE)"
120 INPUT A:A1=A1+A
130 IF A=0 THEN 150
140 GOTO 120
150 GOSUB 180:GOSUB 190:RETURN
160 PRINT "{CLEAR}":RETURN
170 PRINT " ";A$(X*8-7,X*8);" BILL(C
    ONT')":PRINT :RETURN
180 FOR I=1 TO 3:PRINT :NEXT I:RETUR
    N
190 PRINT "INPUT C TO CONTINUE";:INP
    UT C$:GOSUB 160:RETURN
200 DIM L1(3),L2(3),M(4),N(4),R1(3),
    R2(3),R3(3),W(50),Z(4),A$(40),B$
    (9),C$(1)
210 A$="ELECTRICGAS{5 SPACES}WATER
    {3 SPACES}PHONE{3 SPACES}"
220 B$="KWHCCFCCF"
230 FOR I=1 TO 4:READ X:N(I)=X:NEXT
    I:FOR I=1 TO 3
240 READ A,B,C,D,E,F,G
250 M(I)=A:Z(I)=B:L1(I)=C:L2(I)=D:R1
    (I)=E:R2(I)=F:R3(I)=G
260 NEXT I
270 READ A,B:M(4)=A:Z(4)=B:GOSUB 160
280 PRINT "{8 RIGHT}UTILITY BILL AUD
    IT"
290 GOSUB 180:PRINT "{3 RIGHT}1. ELE
    CTRIC BILL":PRINT "{3 RIGHT}2. G
    AS BILL"
300 PRINT "{3 RIGHT}3. WATER BILL":P
    RINT "{3 RIGHT}4. PHONE BILL"
310 PRINT "{3 RIGHT}5. ALL OF THE AB
    OVE":PRINT "{3 RIGHT}6. EXIT":PR
    INT :PRINT
320 PRINT "{3 RIGHT}CHOOSE AN OPTION
    ";
330 INPUT P:IF (P<1)+(P>6) THEN 330
340 ON P GOTO 540,550,560,570,760,82
    0
350 GOSUB 160:PRINT "{4 SPACES}";A$(
    X*8-7,X*8);" BILL":PRINT
360 PRINT "PREVIOUS METER READING":I
    NPUT E1:PRINT
370 PRINT "PRESENT METER READING":IN
    PUT E2:PRINT
380 PRINT "INPUT DAYS IN THE BILLING
     PERIOD":INPUT D:GOSUB 180
390 GOSUB 190:GOSUB 160:GOSUB 170:GO
    SUB 110:PRINT :U=E2-E1:Y=U/D
400 IF U>L2(X) THEN 440
410 IF U>L1(X) THEN 430
420 T=M(X)+R1(X)*U:GOTO 450
430 T=M(X)+R1(X)*L1(X)+R2(X)*(U-L1(X
    )):GOTO 450
440 T=M(X)+R1(X)*L1(X)+R2(X)*(L2(X)-
    L1(X))+R3(X)*(U-L2(X))
450 T1=T*Z(X):T2=T+T1:T3=T2+A1:GOSUB
     160:GOSUB 170
460 PRINT "USE FOR THE PERIOD IS ";I
```

Atari Version Notes For Utility Bill Audit

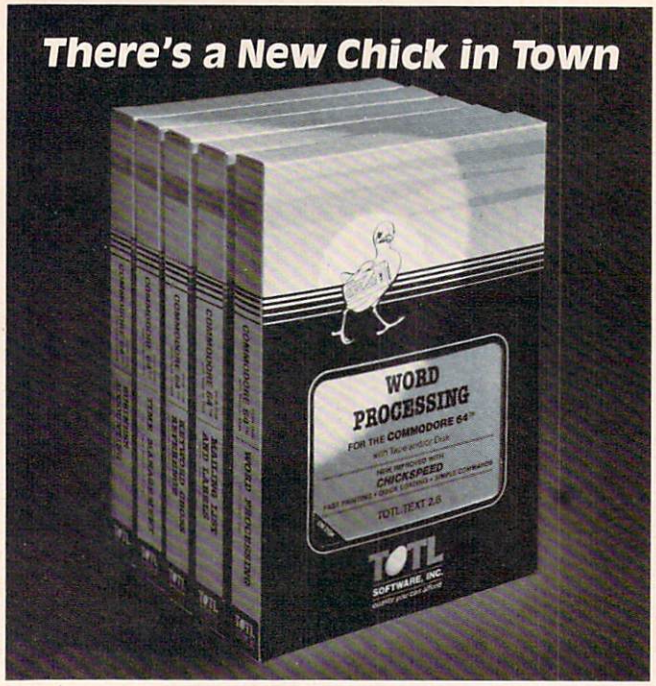
Patrick Parrish, Programming Supervisor

The Atari version (Program 2) of "Utility Bill Audit" is set up like the Microsoft version. The primary difference in the Atari version, of course, is its handling of strings. A$(X) and B$(X) were used to define the type of utility and its units of usage in the Microsoft version. Since the Atari doesn't allow string arrays, A$ and B$ must be defined as one long string of individual substrings representing all utilities and their units. This is accomplished in lines 210 and 220. Thus, when a bill for a particular utility is to be checked, a corresponding portion of A$ and B$ will be accessed accordingly.

As an example of this, look at the statement in line 170. If you were checking an electric bill, then X would equal 1 and the first eight characters in A$ or ELECTRIC would be PRINTed along with the word BILL.

After removing entries for A$ and B$ from the DATA statements in lines 780 to 810, the remainder of these entries are defined by the same variables as they are in the Microsoft version. Read over the discussion on these DATA statements in the article. Then, adjust the values contained therein according to your local utility rate schedules.

There's a New Chick in Town



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```
    NT(U*100)/100;" ";B$(X*3-2,X*3):
    PRINT
470 PRINT "USE/DAY IS ";INT(Y*100)/1
    00;" ";B$(X*3-2,X*3);" OR $";
480 PRINT INT(T2/D*100)/100;"/DAY":P
    RINT "INCLUDING TAX":PRINT :PRIN
    T A$(X*8-7,X*8);" BILL:"
490 PRINT " W/OUT TAX: $";INT(T*100)
    /100:PRINT " TAX IS{3 SPACES}: $
    ";INT(T1*100)/100
500 PRINT " ADJ'TS{3 SPACES}: $";A1:
    PRINT :PRINT "  *TOTAL* : $";INT
    (T3*100)/100
510 IF N(X)=1 THEN 530
520 PRINT :PRINT "SPLIT ";N(X);" WAY
    S:$";INT(T3/N(X)*100)/100
530 PRINT :GOSUB 190:RETURN
540 X=1:GOSUB 350:GOTO 290
550 X=2:GOSUB 350:GOTO 290
560 X=3:GOSUB 350:GOTO 290
570 GOSUB 160:X=4:PRINT "{4 SPACES}"
    ;A$(X*8-7,X*8);" BILL"
580 PRINT :GOSUB 110
590 PRINT :FOR K=1 TO N(X):I=1:IF N(
    X)=1 THEN 610
600 PRINT "  FOR PERSON #";K;",";
610 PRINT "INPUT CHARGE FOR EACH LON
    G DISTANCE CALL (INPUT '0' WHEN
    {4 SPACES}DONE)"
620 INPUT D:W(I)=D:IF W(I)=0 THEN 64
    0
630 I=I+1:GOTO 620
640 GOSUB 160:FOR J=1 TO I-1:PRINT "
     PERSON #";K;",";
650 PRINT "CALL #";J;" :$";W(J):PRIN
    T :PRINT "IS THIS CORRECT (Y/N)"
660 INPUT C$:IF C$="Y" THEN 680
670 PRINT "TYPE IN CORRECTION":INPUT
     D:W(J)=D
680 PRINT :NEXT J
690 GOSUB 160:GOSUB 170:T=0:FOR J=1
    TO I-1
700 T=T+W(J):NEXT J:PRINT "SERVICE:
    {3 SPACES}$";INT(M(X)/N(X)*100)/
    100:PRINT
710 PRINT "LD CALLS:  $";T:PRINT
720 PRINT "ADJ'TS :{3 SPACES}$";INT(
    A1/N(X)*100)/100:PRINT
730 T1=T+INT(M(X)/N(X)*100)/100:T2=I
    NT(T1*Z(X)*100)/100
740 PRINT "TOTAL TAX: $";T2:PRINT :P
    RINT
750 PRINT " TOTAL BILL: $";T1+T2+INT
    (A1/N(X)*100)/100:GOSUB 180:GOSU
    B 190:NEXT K:GOTO 290
760 FOR F=1 TO 3:X=F:GOSUB 350:NEXT
    F:GOTO 570
770 DATA 2,1,2,4
780 DATA 5.40,0,350,1300,.0495,.0565
    ,.0541
790 DATA 4.05,0,99999,99999,.49541,0
    ,0
800 DATA 3.26,0,1000,99999,.144,.160
    ,0
810 DATA 13.50,.03
820 END
```


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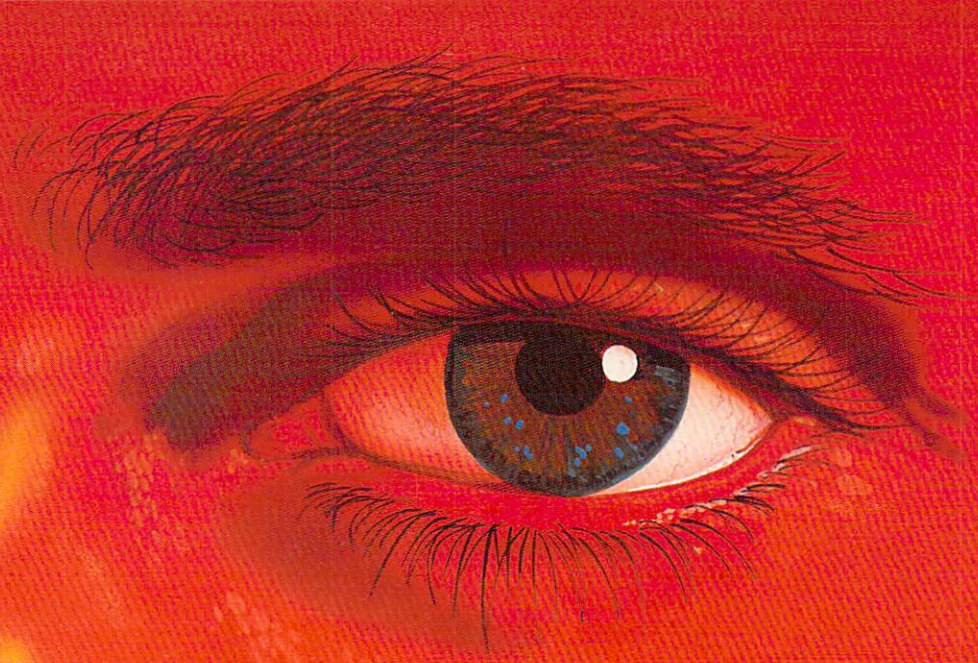

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Gas Mileage

Ron Blue

Here's a valuable program if you're economy-minded. You can monitor your vehicle's performance with a hi-res graphics display of your odometer reading, gas mileage, standard deviation of mileage data, and reference dates. Originally written for the Apple, versions for the Atari, 64, and VIC (with Super Expander) are included. A disk drive is required.

"Gas Mileage," originally written for the Apple, is a simple but effective program that displays, in high-resolution (hi-res) graphics, the total cumulative average gas mileage for up to 200 (50 for VIC version) fill-ups. Also, mileage, gas mileage, standard deviation of gas mileage data, and reference dates are displayed at the bottom of the screen.

If you compulsively keep records of gas mileage of your car or cars, you probably have noticed that there is often significant variability. Many factors can cause this: whether you are getting a "total" fill, which gas station you are getting your gas from, what type of driving you have been doing, the mechanical condition of your car, and weather conditions. If you own a small economy car, you have probably experienced the frustration of seeing results ranging from 10 to 40 miles to the gallon. Such data is useless to reveal whether or not changes you've made in your vehicle or driving habits are effective. If you own more than one vehicle, you might want to make a scientific comparison to determine which vehicle is giving you the best service.

Operating The Program

Gas Mileage is menu-driven and designed for use with a disk drive. The main menu consists of three choices:

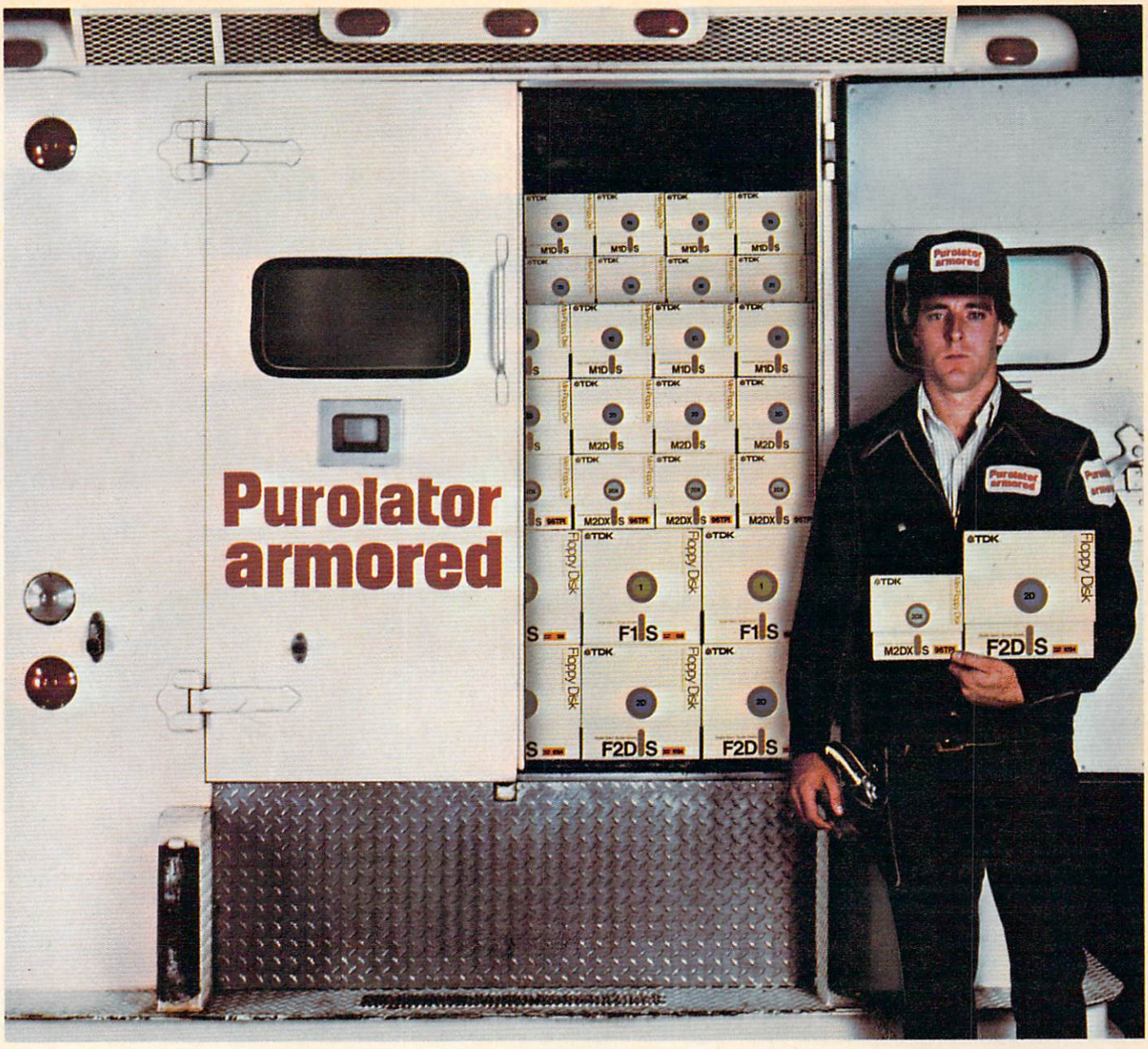
(1) GAS MILEAGE DISPLAY
(2) PROGRAM FOR THOSE WANTING A PRINTER OPTION
(3) OPTION FOR CREATING A NEW DATA FILE FOR ANOTHER VEHICLE

When you first run the program and the main menu is displayed, you'll have to choose option 3 to create an initial data file. The program will branch to line 610, which asks you to INPUT CAR'S NAME:. The car's name (N$) becomes the data file's name. Any number of data files can be created and used in the program as long as no name is used twice. (This file naming technique can be valuable for other programs as it allows maximum use of the same program for different data files.) When using any N$ input string variable to equal your desired data files, you can save yourself some typing by using the following sequence: "OPEN";N$:"READ OR WRITE";N$:"CLOSE";N$.

Lines 620 – 700 create a data file that can be READ without causing an END OF DATA ERROR message. The Z variable used at line 680 will be used to tell the READ command how many DATA statements are to be read — in other words, how many entries have been made for mileage and distance. This technique is useful when the number of data entries is constantly changing. If you use the APPEND DOS command for adding new data to your data files, the Z variable can be corrected if you POSITION DOS to location zero and then WRITE in the value of Z and CLOSE the data file. If you are making multiple entries of new data to your data file, I recommend that you not use the APPEND command for writing in data files.

Data Options

After you have run the program and created the data file, the next display on the screen will be CHOOSE YOUR PROGRAM OPTIONS. Lines 200 – 260 allow you to select one of four program



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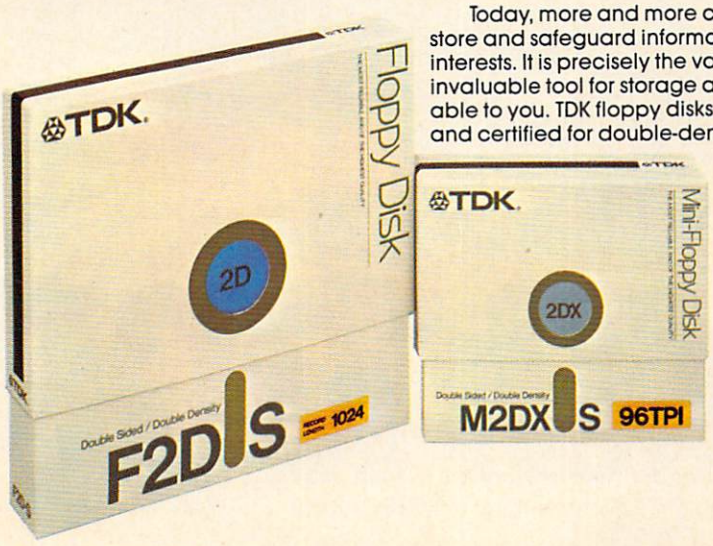

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options:

(1) DISPLAY GAS MILEAGE
(2) INPUT NEW DATA
(3) CREATE BACKUP DATA FILE
(4) RETURN TO MAIN MENU

I used a GET X$ request at line 240 and then changed the X$ to an X variable number. The reason: If a letter is accidentally pressed, the program will crash and you will have to reload your data file.

Since you do not yet have any gas mileage data to be displayed, we'll discuss option 1 last. Option 2, INPUT NEW DATA (lines 490 – 570), lets you input your mileage readings and the amount of gas used to fill the vehicle. The I variable is used as a data interval. Since data is to be added to the data file, the interval variable equals the total current number of DATA statements. The data interval and the Z variable (total number of DATA statements) are then increased by one.

Since the variables used to represent current odometer reading and gas are dimensioned to 200 variable statements each, you should be able to store data representing about 35,000 miles before you will have to increase the number of dimensioned variable statements. Your data will eventually run into the hi-res screen as you run out of memory. You can then create new data files to contain your additional data, or delete parts of the program you find unnecessary.

The screen displays the last stored mileage and asks you to INPUT CURRENT MILEAGE. To get your data file running, your first mileage is used as a starting location and stored as if you'd used no gas, regardless of what you had typed in. (Gas mileage calculations are actually started with your second data entry.) Next, you simply input the odometer reading at the time you filled up your vehicle. For example: 37324 miles, and gas used since last fill-up, 12.3 gallons.

The next screen display (lines 500 – 560) permits correction of an entry before it is stored in the data file:

SUB-MENU
(1) TO END DATA INPUT & STORE DATA
(2) TO RE-ENTER LAST DATA ENTRY
(3) TO ENTER MORE DATA
(4) TO ENTER REFERENCE DATE FOR FILL UP

Option 2 allows you to correct a mistyped entry. Use option 3 to continue inputting data until you're finished. Option 1 ends data input and stores your data file on disk. Option 4 processes a date for future reference and display. Keep your reference dates to a minimum to save memory.

After the data has been stored in your data file, you are automatically sent back to the program options. After doing all that data entry, you should now use option 3, CREATE BACKUP DATA FILE.

The Heart Of The Program

When you choose option 1, DISPLAY GAS MILEAGE (lines 270 – 480), the screen display asks you to INPUT ESTIMATED AVERAGE GAS MILEAGE. Your input (XG) is then acted on by lines 270 – 290 and line 440 in adjusting the hi-res screen position of the data that will be displayed. Depending on the individual characteristics of your vehicle, you might like to change the value of the XG variable to position your data display to suit your taste.

The total cumulative average gas mileage is calculated for each input of current mileage and total gas used. The average gas mileage is plotted as a point on the hi-res screen. In addition, gas mileage and standard deviation are provided at the bottom of the screen. When a bell sounds, a new reference date is printed at the bottom of the screen.

For those unfamiliar with standard deviation, it is a mathematical expression of the variability of data about a mean. The standard deviation can be used to clarify the meaning and the causes of events. The hi-res screen display does for you visually what science relies on statistical analysis to accomplish.

Line 330 is used to increase the data interval by one, so that gas and current odometer readings can be translated and used to calculate gas mileage. X is the total distance traveled, and F is the total fuel used to travel that distance. MG represents the total average miles per gallon. M1 is the total cumulative sum of the squares of miles per gallon, and M2 is the sum of the miles per gallon. Using M1, M2, and N (the total number of entries), the standard deviation is calculated. Lines 350 – 370 carry out these functions.

Line 390 displays at the bottom of the hi-res screen the following: mileage, miles per gallon (MG), and standard deviation (SD). Line 400 displays the reference dates.

Next, each total cumulative gas mileage is translated into a coordinate to be plotted on the hi-res screen at lines 440 – 480. The A variable represents this coordinate. The Y variable is used to position the next graphic plotting of gas mileage slightly to the right of the last gas mileage plotted. The gas mileage is multiplied by the constant provided at lines 270 – 290, and the value subtracted from 600. This enhances graphic display of data and allows for normal graphic display of higher and lower gas mileage as would be expended in the upper-right graphic coordinate system. The hi-res plotting system is in the lower right of the normal graphic coordinate system. Lines 420 and 430 can be changed to stop the erasure of the hi-res screen if your data exceeds the right side of the

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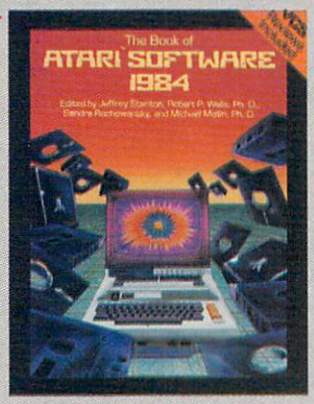

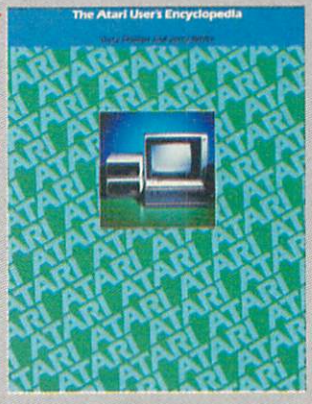

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```
640  PRINT D$;"OPEN";N$;"'S DATA"
650  PRINT D$;"DELETE";N$"'S DATA"
660  PRINT D$;"OPEN";N$"'S DATA"
670  PRINT D$;"WRITE";N$"'S DATA"
680  PRINT Z: IF Z = 0 THEN  GOTO 700
690  FOR I = 0 TO Z: PRINT D(I): PRINT
     G(I): PRINT A$(I): NEXT
700  PRINT D$;"CLOSE";N$"'S DATA"
710  IF BU = 1 THEN BU = 0: RETURN
720  GOTO 200
730  HOME
740 BU$ = "BACKUP ":BU = 1:UB$ = N$:N$ =
     BU$ + UB$: GOSUB 620
750 N$ = UB$: GOTO 200
760  HOME : PRINT "PRINTER OPTIONS:"
770  PRINT : PRINT "(1) PRINT MILEAGE A
     ND GAS MILEAGE DATA"
780  PRINT "(2) PRINT HI-RES GRAPHICS "

790  PRINT "(3) PRINT BOTH OPTIONS 1 AN
     D 2"
800  PRINT "(4) TURN PRINTER OFF"
810  VTAB 1: HTAB 18: GET X$:X =  VAL (
     X$)
820  IF X > 0 GOTO 840
830  GOTO 760
840 PR% = X: IF X = 4 THEN PR% = 0
850  VTAB 10:A$ = "PRINTER OPTION INITI
     ALIZED."
860  HTAB (20 -  LEN (A$) / 2): INVERSE
     : PRINT A$: NORMAL
870  FOR X = 1 TO 2000: NEXT
880  GOTO 50
```

Program 2: Gas Mileage — Atari

```
1 OPEN #1,4,0,"K:"
2 GOSUB 900
5 DIM X$(1),D(200),G(200),A(200),N$(
  15),FILE$(15),B(200),C(200),BU$(15
  ),UB$(15),A$(192)
6 GRAPHICS 0:POKE 752,1
10 POSITION 14,10:? "GAS MILEAGE"
30 POSITION 7,23:? "PRESS ANY KEY TO
    CONTINUE";:GET #1,X
50 POKE 752,1:? "{CLEAR}":? "MENU:"
60 ? :? "(1) GAS MILEAGE DISPLAY"
70 ? :? "(2) PROGRAM FOR THOSE WANTI
   NG A{11 SPACES}PRINTER OPTION"
80 ? :? "(3) OPTION FOR CREATING A N
   EW DATA{8 SPACES}FILE FOR ANOTHER
    VEHICLE"
90 POSITION 7,0:GET #1,X:? "{CLEAR}"
95 X=X-ASC("0"):IF X<0 OR X>3 THEN X
   =0
96 POKE 752,0
100 ON X GOTO 120,760,610
110 GOTO 50
120 ? "{CLEAR}":? :POSITION 2,10:? "
    INPUT CAR'S NAME: ";:INPUT N$
130 ? "{CLEAR}":POSITION 2,10:? "COM
    PUTER IS LOADING DATA"
140 FILE$="D:":FILE$(3)=N$
150 TRAP 890:OPEN #2,4,0,FILE$
160 INPUT #2,Z:IF Z=0 THEN 190
170 FOR I=0 TO Z:INPUT #2,Y:D(I)=Y:I
    NPUT #2,Y:G(I)=Y:INPUT #2,Y:A(I)
    =Y:INPUT #2,Y:B(I)=Y
180 INPUT #2,Y:C(I)=Y:NEXT I
190 CLOSE #2:TRAP 40000
200 POKE 752,1:? "{CLEAR}":POSITION
    2,10:? "CHOOSE YOUR PROGRAM OPTI
    ONS"
210 ? :? "(1) DISPLAY YOUR MILEAGE":
    ? "(2) INPUT NEW DATA"
220 ? "(3) CREATE BACKUP DATA FILE"
230 ? "(4) RETURN TO MAIN MENU"
240 POSITION 31,10:GET #1,X:? "
    {CLEAR}"
245 X=X-ASC("0"):IF X<0 OR X>4 THEN
    X=0
246 POKE 752,0
250 ON X GOTO 270,485,730,50
260 GOTO 200
270 ? "{CLEAR}":POSITION 2,10:? "INP
    UT ESTIMATED AVERAGE GAS MILEAGE
    :":INPUT XG
280 IF XG>=20 THEN XG=20
290 IF XG<20 THEN XG=30
300 I=-1:X=0:N=0:M1=0:M2=0:F=0:Y=0
305 IF PR=0 OR PR=2 THEN CLOSE #3:OP
    EN #3,8,0,"E:"
310 IF PR=1 OR PR=3 THEN CLOSE #3:OP
    EN #3,8,0,"P:"
315 GRAPHICS 8:COLOR 1:POKE 752,1
320 IF (PR=2 OR PR=3) AND I=Z THEN C
    LOSE #3:OPEN #3,8,0,"P:":GOSUB 9
    30
330 I=I+1:IF I=Z+1 THEN POKE 656,2:P
    OKE 657,0:? "PRESS ANY KEY TO CO
    NTINUE";:GET #1,X:GRAPHICS 0:GOT
    O 200
340 G=G(I):D=D(I)-D1:D1=D(I):IF G(I)
    =0 THEN 310
350 X=X+D:F=F+G:MG=X/F:MG=100*MG:MG=
    INT(MG):MG=MG/100
360 MP=D/G:M1=M1+(MP*MP):N=N+1:M2=MP
    +M2:M3=M2/N:M4=M1/N:M5=M3^2:SS=(
    M4-M5)
365 IF SS>0 THEN SD=SS^0.5
370 SD=100*SD:SD=INT(SD):SD=SD/100
380 POKE 656,0:POKE 657,0
390 ? #3;"MILEAGE=";D(I),"MG=";MG,"S
    D=";SD
400 IF A(I)>0 THEN POKE 656,1:POKE 6
    57,0:? #3;"DATE:";A(I);"/";B(I);
    "/";C(I);"{5 SPACES}"
410 PLOT 319,159:DRAWTO 0,159
420 Y=Y+2:IF Y>319 THEN Y=0:IF PR=2
    OR PR=3 THEN CLOSE #3:OPEN #3,8,
    0,"P:":GOSUB 930:CLOSE #3:GRAPHI
    CS 8
430 IF Y=0 THEN GRAPHICS 8:POKE 752,
    1
440 A=XG*MG
450 A=500-A
460 IF A<0 THEN A=0
465 IF A>159 THEN A=159
470 PLOT Y,A
480 GOTO 320
485 TRAP 500
490 I=Z:? "LAST STORED MILEAGE: ";D(
    I):? :? "CURRENT MILEAGE";:INPUT
     X:D(I+1)=X:? :? "GAS USED";
492 INPUT X:D(I+1)=X:I=I+1:Z=I
495 IF LA=1 THEN LA=0:I=I-1:Z=I
500 TRAP 500:POKE 752,1:POSITION 2,1
    4:? "SUB-MENU:"
510 ? :? "(1) TO END DATA INPUT & ST
    ORE DATA"
520 ? "(2) TO RE-ENTER LAST DATA ENT
    RY"
530 ? "(3) TO ENTER MORE DATA":?
540 IF L=0 THEN ? "(4) TO ENTER REFE
    RENCE DATE FOR FILL{6 SPACES}UP"
550 POSITION 13,14:GET #1,X:? :POKE
    752,0
```

```
555 X=X-ASC("Ø"):IF X<Ø OR X>4 THEN
    X=Ø
560 ON X GOTO 620,590,600,580
570 GOTO 500
580 ? "{CLEAR}":? "INPUT COMPLETE DA
    TE":POSITION 2,5
585 ? "EXAMPLE: 12,3,1983  IS DEC. 3
    rd 1983":POSITION 2,10:? "DATE:"
    ;:INPUT A,B,C:A(I)=A:B(I)=B:C(I)
    =C:GOTO 500
590 LA=1:POSITION 2,8:GOTO 490
600 ? "{CLEAR}":GOTO 490
610 ? :? :? "INPUT CAR'S NAME:";:INP
    UT N$
615 IF LEN(N$)>6 THEN ? "NAME TOO LO
    NG":GOTO 610
616 Z=Ø
617 TRAP 890
620 FILE$="D:":FILE$(3)=N$
630 ? "{CLEAR}":POSITION 2,10:? "COM
    PUTER IS THINKING"
640 OPEN #2,8,Ø,FILE$
680 ? #2,Z:IF Z=Ø THEN 700
690 FOR I=Ø TO Z:? #2,D(I):? #2,G(I)
    :? #2,A(I):? #2,B(I):? #2,C(I):N
    EXT I
700 CLOSE #2:TRAP 40000
710 IF BU=1 THEN BU=Ø:RETURN
720 GOTO 200
730 ? "{CLEAR}"
740 BU$="BU":BU=1:UB$=N$:N$=BU$:N$(3
    )=UB$:TRAP 755:GOSUB 620
750 N$=UB$:GOTO 200
755 CLOSE #2:TRAP 40000:? "INVALID F
    ILE NAME":FOR I=1 TO 500:NEXT I:
    GOTO 200
760 POKE 752,1:? "{CLEAR}":? "PRINTE
    R OPTIONS:"
770 ? :? "(1) PRINT MILEAGE AND GAS
    MILEAGE DATA";
780 ? "(2) PRINT HI-RES GRAPHICS"
790 ? "(3) PRINT BOTH OPTIONS 1 AND
    2"
800 ? "(4) TURN PRINTER OFF"
810 POSITION 20,1:GET #1,X
815 X=X-ASC("Ø")
820 IF X>Ø AND X<5 THEN 840
830 GOTO 760
840 PR=X:IF X=4 THEN PR=Ø
850 A$="PRINTER OPTIONS INITIALIZED.
    "
860 POSITION (20-LEN(A$)/2),10:? A$
870 FOR X=1 TO 500:NEXT X
880 GOTO 50
890 CLOSE #2:TRAP 40000:? "INVALID F
    ILE NAME":FOR I=1 TO 500:NEXT I:
    GOTO 50
900 FOR B=1 TO 61:READ N:POKE 1535+B
    ,N:NEXT B:RETURN
910 DATA 104,104,141,21,6,104,141,20
    ,6,104,141,27,6,104,141,26,6,160
    ,193,173,255,255,136,240,35,141,
    255,255,238
920 DATA 26,6,240,21,173,20,6,56,233
    ,40,141,20,6,144,4,24,76,19,6,20
    6,21,6,76,19,6,238,27,6,76,33,6,
    96
930 DM=PEEK(88)+PEEK(89)*256:DM=DM+4
    Ø*191
940 LPRINT CHR$(27);"A";CHR$(8):FOR
    X=DM TO DM+39
950 A$=CHR$(Ø):A$(192)=CHR$(Ø):A$(2)
    =A$
960 W=USR(1536,X,ADR(A$)):LPRINT CHR
    $(27);"K";CHR$(192);CHR$(Ø);A$
970 NEXT X:RETURN
```

Program 3: Gas Mileage — 64

```
5 PRINT"{CLR}{11 RIGHT}{13 DOWN}GAS MILEA
  GE PROGRAM"
10 GOSUB4000
20 DIMD(200),G(200)
25 PRINT"{8 UP}";
30 PRINT"{CLR}":PRINT"MAIN MENU":PRINT
40 PRINT"(1)GAS MILEAGE DISPLAY":PRINT
60 PRINT"(2)CREATE A NEW FILE":PRINT
61 PRINT"(3)ENTER NEW DATA IN FILE":PRINT
62 PRINT"(4)EXIT PROGRAM"
70 GETX$:IFX$=""THEN70
71 X=VAL(X$):PRINT"{CLR}"
80 ONXGOTO120,610,652,800
110 GOTO30
120 PRINT"{CLR}":PRINT"INPUT CAR'S NAME:"
    :INPUTN$
130 PRINT"{CLR}":PRINT"COMPUTER IS LOADIN
    G"
140 B$="Ø:"+N$+",S,R"
150 OPEN3,8,3,B$
170 INPUT#3,Z:IF Z=Ø THEN 181
180 FORI=ØTOZ:INPUT#3,D(I),G(I):NEXTI
181 CLOSE3
190 PRINT"{CLR}"
200 PRINT"CHOOSE YOUR OPTIONS":PRINT:PRIN
    T
210 PRINT"(1)DISPLAY GAS MILEAGE":PRINT
211 PRINT"(2)INPUT NEW DATA":PRINT
220 PRINT"(3)CREATE BACKUP FILE":PRINT
230 PRINT"(4)RETURN TO MAIN MENU"
240 GET X$:IFX$=""THEN240
241 X=VAL(X$):PRINT"{CLR}"
250 ONXGOTO270,490,730,30
260 GOTO200
270 PRINT"ESTIMATED GAS MILEAGE":INPUTXG:
    X=FRE(Ø):PRINT"{CLR}"
271 PRINT"INSTRUCTIONS ON GRAPH:":PRINT
272 PRINT"HORIZONTAL:"
273 PRINT"# OF DATA POINTS":PRINT:PRINT:P
    RINT
274 PRINT"VERTICAL:"
```

Notes For VIC-20 And 64 Versions of Gas Mileage

The VIC and 64 versions of "Gas Mileage" are very similar to the Atari and Apple versions. However, they do not offer the printer option found in the Atari and Apple versions. The VIC version requires the Super Expander cartridge to plot the graph.

```
275 PRINT"ACTUAL GAS MILEAGE":PRINT:PRINT
    :PRINT
276 PRINT"PRESS ANY KEY TO LEAVE GRAPHICS
    "
277 FORJ=1TO1000:NEXTJ
280 IFXG>=20THENXG=20
290 IFXG<20THENXG=30
295 POKE53272,PEEK(53272)OR8:POKE53265,PE
    EK(53265)OR32
296 SYS49710
300 I=-1:X=0:N=0:M1=0:M2=0:F=0:Y=0
330 I=I+1:IFI=Z+1THEN381
340 G=G(I):D=D(I)-D1:D1=D(I):IFG=0THEN330
350 X=X+D:F=F+G:MG=X/F:MG=INT(100*MG)/100
360 MP=D/G:M1=M1+(MP*MP):N=N+1:M2=MP+M2
361 M3=M2/N:M4=M1/N:M5=M3↑2:SS=M4-M5
362 IFSS>0THENSD=SQR(SS)
370 SD=INT(100*SD)/100
380 GOTO420
381 IFPEEK(197)=64THEN381
382 POKE53272,21:POKE53265,27
383 FORJ=1TO30:NEXTJ:PRINT"{CLR}"
390 PRINT"MILEAGE=";D(I-1)
391 PRINT"MG=";MG
392 PRINT"SD=";SD
393 FORJ=1TO10:PRINT:NEXTJ
394 PRINT"PRESS ANY KEY!"
396 IFPEEK(197)=64THEN396
400 GOTO480
420 Y=Y+10:IFY>319THENY=0
430 IFY=0THENSYS49710
440 A=(XG*MG)
450 A=500-A
460 IFA<0THENA=0
465 IFA>199THENA=199
470 Y=INT(Y+.5):A=INT(A+.5):POKE53240,A:P
    OKE53241,0
471 POKE53242,Y:IFY>255THENPOKE53243,1:PO
    KE53242,Y-256
472 IFY<255THENPOKE53243,0
473 SYS49408
475 GOTO330
480 POKE198,0:POKE53272,21:POKE53265,27:G
    OTO190
490 PRINT"{CLR}":I=Z: I= I+1:Z=I
491 PRINT"LAST MILEAGE WAS:";D(I-1):PRINT
492 PRINT"CURRENT READING:":INPUTD(I)
493 PRINT"GAS USED":INPUTG(I)
494 PRINT"{CLR}"
495 IF I=1 THEN G(I)=0
500 PRINT"SUB-MENU":PRINT:PRINT
510 PRINT"(1)TO END DATA INPUT":PRINT
520 PRINT"(2)RE-ENTER LAST DATA":PRINT
530 PRINT"(3)ENTER MORE DATA":PRINT
550 GETX$:IFX$=""THEN550
551 X=VAL(X$):PRINT
560 ONXGOTO654,590,600
570 GOTO500
590 I=I-1:Z=I:GOTO490
600 PRINT"{CLR}":GOTO490
610 PRINT:PRINT"INPUT CAR'S NAME:":INPUTN
    $
630 PRINT"{CLR}":PRINT"COMPUTER IS THINKI
    NG"
640 Z=0
650 OPEN2,8,2,N$+",S,W":PRINT#2,Z:CLOSE2
651 OPEN15,8,15,"IO":CLOSE15:GOTO40
652 PRINT"PRINT CAR'S NAME:"
653 INPUTN$:PRINT"{CLR}"
654 PRINT"{CLR}":PRINT"PLEASE WAIT"
660 A$="@0:"+N$+",S,W"
670 OPEN1,8,9,A$
680 PRINT#1,Z:IFZ=0THEN700
690 FORI=0TOZ:PRINT#1,D(I):PRINT#1,G(I):N
    EXTI
700 CLOSE1
710 IFBU=1THENBU=0:RETURN
720 GOTO190
730 PRINT"{CLR}"
740 BU$="BACKUP":BU=1:UB$=N$:N$=BU$+UB$:G
    OSUB654
750 N$=UB$:GOTO190
760 GOTO30
800 END
4000 I=49408
4020 READ A:CK=CK+A:IF A=256 THEN 4040
4030 POKE I,A:I=I+1:GOTO 4020
4040 IFCK<>61125THENPRINT"ERROR IN DATA S
    TATEMENTS":STOP
4050 RETURN
49408 DATA 173,250,207,141,212,207,173
49416 DATA 251,207,141,213,207,173,248
49424 DATA 207,141,214,207,173,249,207
49432 DATA 141,215,207,173,215,207,74
49440 DATA 141,217,207,173,214,207,106
49448 DATA 141,216,207,173,217,207,74
49456 DATA 141,217,207,173,216,207,106
49464 DATA 141,216,207,173,217,207,74
49472 DATA 141,217,207,173,216,207,106
49480 DATA 141,216,207,173,213,207,74
49488 DATA 141,219,207,173,212,207,106
49496 DATA 141,218,207,173,219,207,74
49504 DATA 141,219,207,173,218,207,106
49512 DATA 141,218,207,173,219,207,74
49520 DATA 141,219,207,173,218,207,106
49528 DATA 141,218,207,173,214,207,41
49536 DATA 7,141,220,207,173,216,207
49544 DATA 10,46,217,207,10,46,217
49552 DATA 207,10,141,210,207,46,217
49560 DATA 207,173,217,207,141,211,207
49568 DATA 173,210,207,10,46,217,207
49576 DATA 10,46,217,207,109,210,207
49584 DATA 141,216,207,173,211,207,109
49592 DATA 217,207,141,217,207,173,216
49600 DATA 207,10,46,217,207,10,46
49608 DATA 217,207,10,46,217,207,141
49616 DATA 216,207,173,218,207,10,46
49624 DATA 219,207,10,46,219,207,10
49632 DATA 46,219,207,141,218,207,24
49640 DATA 173,216,207,109,218,207,141
49648 DATA 208,207,173,217,207,109,219
49656 DATA 207,141,209,207,24,173,220
49664 DATA 207,109,208,207,141,208,207
49672 DATA 169,0,109,209,207,141,209
49680 DATA 207,24,169,32,109,209,207
49688 DATA 141,209,207,173,208,207,133
49696 DATA 251,173,209,207,133,252,173
49704 DATA 212,207,41,7,141,225,207
49712 DATA 56,169,7,237,225,207,141
49720 DATA 225,207,169,0,141,206,207
49728 DATA 56,173,225,207,46,206,207
49736 DATA 206,225,207,16,245,160,0
49744 DATA 177,251,13,206,207,145,251
49752 DATA 96,169,147,32,210,255,169
49760 DATA 0,162,0,157,0,32,157
49768 DATA 0,33,157,0,34,157,0
49776 DATA 35,157,0,36,157,0,37
49784 DATA 157,0,38,157,0,39,157
49792 DATA 0,40,157,0,41,157,0
49800 DATA 42,157,0,43,157,0,44
```

```
49808 DATA 157,0,45,157,0,46,157
49816 DATA 0,47,157,0,48,157,0
49824 DATA 49,157,0,50,157,0,51
49832 DATA 157,0,52,157,0,53,157
49840 DATA 0,54,157,0,55,157,0
49848 DATA 56,157,0,57,157,0,58
49856 DATA 157,0,59,157,0,60,157
49864 DATA 0,61,157,0,62,157,0
49872 DATA 63,232,208,157,169,1,162
49880 DATA 0,157,0,4,157,0,5
49888 DATA 157,0,6,157,0,7,232
49896 DATA 208,241,96,256
```

Program 4:

Gas Mileage — For VIC With Super Expander

```
20 DIMD(50),G(50)
25 PRINT"{8 UP}";
30 PRINT"{CLR}":PRINT"MAIN MENU":PRINT
40 PRINT"(1)GAS MILEAGE DISPLAY"
60 PRINT"(2)CREATE A NEW FILE":PRINT
61 PRINT"(3)ENTER NEW DATA IN{5 SPACES}FI
   LE":PRINT
62 PRINT"(4)EXIT PROGRAM"
70 GETX$:IFX$=""THEN70
71 X=VAL(X$):PRINT"{CLR}"
80 ONXGOTO120,610,652,6030
110 GOTO30
120 PRINT"{CLR}":PRINT"INPUT CAR'S NAME:"
    :INPUTN$
130 PRINT"{CLR}":PRINT"COMPUTER IS LOADIN
    G"
140 B$="0:"+N$+",S,R"
150 OPEN3,8,3,B$
170 INPUT#3,Z:IFZ=0THEN181
180 FORI=0TOZ:INPUT#3,D(I),G(I):NEXTI
181 CLOSE3
190 PRINT"{CLR}"
200 PRINT"CHOOSE YOUR OPTIONS":PRINT:PRIN
    T
210 PRINT"(1)DISPLAY GAS MILEAGE"
211 PRINT"(2)INPUT NEW DATA":PRINT
220 PRINT"(3)CREATE BACKUP FILE":PRINT
230 PRINT"(4)RETURN TO MAIN MENU"
240 GET X$:IFX$=""THEN240
241 X=VAL(X$):PRINT"{CLR}"
250 ONXGOTO270,490,730,30
260 GOTO200
270 PRINT"ESTIMATED GAS MILEAGE":INPUTXG:
    X=FRE(0):PRINT"{CLR}"
271 PRINT"INSTRUCTIONS ON GRAPH:":PRINT
272 PRINT"HORIZONTAL:"
273 PRINT"# OF DATA POINTS":PRINT:PRINT:P
    RINT
274 PRINT"VERTICAL:"
275 PRINT"ACTUAL GAS MILEAGE":PRINT:PRINT
    :PRINT
276 PRINT"PRESS ANY KEY TO LEAVE
    {3 SPACES}GRAPHICS"
277 FORJ=1TO4000:NEXTJ
280 IFXG>=20THENXG=20
290 IFXG<20THENXG=30
300 PRINT"{CLR}":I=-1:X=0:N=0:M1=0:M2=0:F
    =0:Y=0
330 I=I+1:IFI=Z+1THEN381
340 G=G(I):D=D(I)-D1:D1=D(I):IFG=0THEN330
350 X=X+D:F=F+G:MG=X/F:MG=INT(100*MG)/100
360 MP=D/G:M1=M1+(MP*MP):N=N+1:M2=MP+M2
361 M3=M2/N:M4=M1/N:M5=M3↑2:SS=M4-M5
362 IFSS>0THENSD=SQR(SS)
370 SD=INT(100*SD)/100
380 GOTO420
381 IFPEEK(197)=64THEN381
382 GRAPHIC0
383 FORJ=1TO30:NEXTJ:PRINT"{CLR}"
390 PRINT"MILEAGE=";D(I-1)
391 PRINT"MG=";MG
392 PRINT"SD=";SD
393 FORJ=1TO10:PRINT:NEXTJ
394 PRINT"PRESS ANY KEY!"
396 IFPEEK(197)=64THEN396
400 GOTO480
420 Y=Y+40:IFY>1023THENY=0
430 IFY=0THEN:GRAPHIC3:COLOR11,6,0,0
431 GRAPHIC3:COLOR11,6,0,0
440 A=XG*MG
450 A=500-A
460 IFA<0THENA=0
465 IFA>1023THENA=1023
470 Y=INT(Y):A=INT(A+150):POINT6,Y,A
475 GOTO330
480 POKE198,0:GRAPHIC0:POKE36879,190:GOTO
    190
490 PRINT"{CLR}":I=Z: I=I+1:Z=I
491 PRINT"LAST MILEAGE WAS:";D(I-1):PRINT
492 PRINT"CURRENT READING:":INPUTD(I)
493 PRINT"GAS USED":{7 SPACES}INPUTG(I)
494 PRINT"{CLR}"
500 PRINT"SUB-MENU":PRINT:PRINT
510 PRINT"(1)TO END DATA INPUT":PRINT
520 PRINT"(2)RE-ENTER LAST DATA":PRINT
530 PRINT"(3)ENTER MORE DATA":PRINT
550 GETX$:IFX$=""THEN550
551 X=VAL(X$):PRINT
560 ONXGOTO654,590,600
570 GOTO500
590 I=I-1:Z=I:GOTO490
600 PRINT"{CLR}":GOTO490
610 PRINT:PRINT"INPUT CAR'S NAME:":INPUTN
    $
630 PRINT"{CLR}":PRINT"COMPUTER IS THINKI
    NG"
640 Z=0
650 OPEN2,8,2,N$+",S,W":PRINT#2,Z:CLOSE2
651 OPEN15,8,15,"IO":CLOSE15:GOTO40
652 PRINT"PRINT CAR'S NAME:"
653 INPUTN$:PRINT"{CLR}"
654 PRINT"{CLR}":PRINT"PLEASE WAIT"
660 A$="@0:"+N$+",S,W"
670 OPEN1,8,9,A$
680 PRINT#1,Z:IFZ=0THENGOTO700
690 FORI=0TOZ:PRINT#1,D(I):PRINT#1,G(I):N
    EXTI
700 CLOSE1
710 IFBU=1THENBU=0:RETURN
720 GOTO190
730 PRINT"{CLR}"
740 BU$="BACKUP":BU=1:UB$=N$:N$=BU$+UB$:G
    OSUB654
750 N$=UB$:GOTO190
760 GOTO30
6000 OPEN15,8,15
6010 INPUT#15,A$,B$,C$,D$:PRINTA$;B$;C$;D
     $
6020 CLOSE15
6030 END
```

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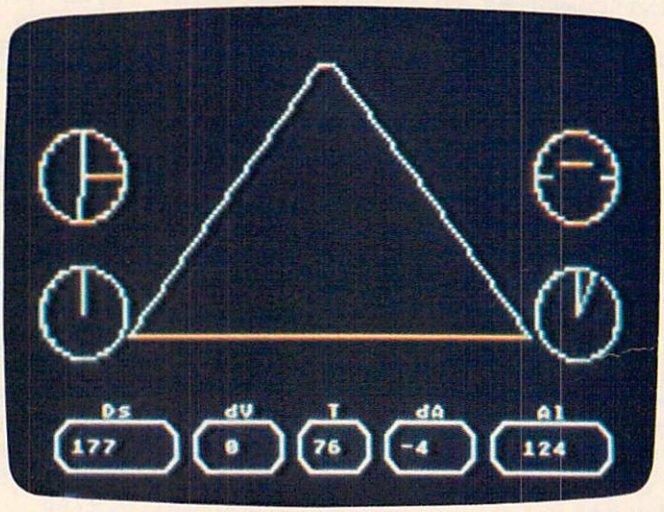
COMPUTE! Books

Nightflyer

David J. Bohlke

You have just assumed control of a light plane in the dead of night, and all you can see is your glowing instrument panel and the faint runway lights in the distance. Will you be able to safely land the plane? Yes, but you'll need pinpoint control and some tricky maneuvering. Written for the Atari (joystick required), and Apple version (joystick or paddles) is included.



Successfully landing your aircraft takes careful navigation. "Nightflyer," Atari version.

"Nightflyer" is a flight simulation game in which you control your joystick to land your plane. It's night and all you can see are your instrument panel and the distant lights of the runway.

To begin, you will need a joystick in Slot 1 of the Atari. The instructions will ask you to pull the joystick down for a Standard start or push it up for a Random beginning. The Standard start will position your plane on the glide path 20000 feet from the runway with an altitude of 1200 feet. The Random start will be more difficult as both distance and altitude will be randomly assigned.

Reading The Instrument Panel

For a safe landing, you'll have to quickly and accurately interpret your instrumentation. The dial on the left center of the screen shows your velocity. Straight up is zero, and the marker at 90 degrees right is the 80 mph indicator. If your velocity dips below 80 mph before you touch down, the plane will stall and crash.

Below the velocity dial is a distance dial with a distance (DS) digit readout. After touchdown, this readout will reset to indicate the distance to the end of the runway.

On the right center of the screen is your glide path dial. You are on the glide path when the orange line is in between the two markers. Below this dial, on the lower right, is an altitude dial with a digital readout (AL) right underneath. Your altitude must remain above 30 feet before you reach the end of the runway, or else you'll crash into the runway lights.

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HOTTEST
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Programmed
by Bill Hogue
2049

bottom of your panel. The delta velocity (dV) digit indicates the rate in mph at which your velocity is changing (5 to −5) each second. The delta altitude gauge (dA) tells your rate of descent or ascent (−25 to 25) in feet per second. On touchdown, your rate of descent cannot exceed −4 feet per second or your landing gear will collapse. There is also a time gauge (T) to indicate how long you have been at the controls.

After Touchdown

Once you touch down, you must stop the plane before you reach the end of the runway. For the quickest stop, make sure the dV gauge is at the minimum (−5). Your stick has four feather controls. Push it up or down to increase or decrease your rate of descent (altitude). Push the stick left or right to decrease or increase your velocity.

When you successfully land, you'll be given a score to evaluate your flight. This score is based on the time it took you to land the plane; your ability to hold it on the glide path; and the distance to the end of the runway once you've stopped. If the plane is above or below the glide path, points are deducted from your score; so it is possible to accumulate a negative score.

It may take you several flights to become adjusted to the control and instrumentation — but with some practice you'll soon be flying for a high score. Scores in excess of 2500 are exceptional.

Program 1: Nightflyer — Atari Version

```
7 HS=0:DIM B$(35)
8 GRAPHICS 7:SETCOLOR 2,0,0:POKE 752
  ,1
9 DEG :GOSUB 800
50 SH=80:SW=160:RL=4000:RW=60
52 T=2:REM T is dist pilot to scrn
54 FS=66/45:REM ft/sec
90 KI=30:VZ=0.85:DZ=83.3:AZ=5:XV=15:
   YV=30:GX=0:XD=15:YD=60:XA=147:YA=
   60
100 D=15000+RND(0)*15000
102 A=900+RND(1)*900
103 IF ST=0 THEN D=20000:A=1200
105 TX=D/150
110 POKE 18,0:POKE 19,0:POKE 20,0
130 RC=0:V=200:PR=0:CR=0
140 BD=0:BA=0
150 RL=4000:RW=60
200 SOUND 0,100-RC,8,6:POKE 77,0
201 SOUND 1,250-V/2,2,2
208 IF PR=0 AND D<4000 AND A>1000 TH
    EN B$="Altitude too high for saf
    e landing":GOTO 500
210 IF A>1 AND V<80 THEN B$="Velocit
    y below stall level (80)":GOTO 5
    00
211 IF A<30 AND PR=0 THEN B$="Altitu
    de below minimum (30)":GOTO 500
212 IF D<1 AND PR=0 THEN D=4000:PR=1
    :SETCOLOR 2,0,4
213 IF D<1 THEN B$="Crashed at the e
    nd of runway.":GOTO 500
214 IF PR=1 THEN 300
215 X=INT(D/1000):IF X<4 THEN 218
216 IF X>=KI THEN 400
218 KI=X:GOSUB 920
220 A1=T*A/D*SH:A2=((T*A)/(D+RL))*SH
230 RF=T*RW/D*SW:L1=(SW-RF)/2:R1=L1+
    RF
240 RR=((T*RW)/(D+RL))*SW:L2=(SW-RR)
    /2:R2=L2+RR
248 IF D<4000 THEN GOSUB 900:GOTO 400
250 GOSUB 900
260 GOTO 400
300 GOSUB 920
310 A1=80:A2=((T*A)/D)*SH:IF A2<1 TH
    EN A2=1
315 IF A<RF THEN RF=RF+1:IF RF>158 T
    HEN RF=158
316 IF A>RF THEN RF=RF-1:IF RF<RR TH
    EN RF=RR+4
320 L1=(SW-RF)/2:R1=L1+RF
325 RR=((T*RW)/(D))*SW:L2=(SW-RR)/2:
    R2=L2+RR
330 GOSUB 900
350 IF A>D/10 THEN B$="Altitude too
    high for safe landing":GOTO 500
400 T1=TI:TI=(PEEK(20)+PEEK(19)*256+
    PEEK(18)*65536)/60:TD=TI-T1
403 X=STICK(0):IF X=15 THEN 450
404 GOTO X+400
405 VD=VD+1:RC=RC-V/40:GOTO 440
406 VD=VD+1:RC=RC+V/40:GOTO 440
407 VD=VD+1:GOTO 440
409 VD=VD-1:RC=RC-V/40:GOTO 440
410 VD=VD-1:RC=RC+V/40:GOTO 440
411 VD=VD-1:GOTO 440
412 IF X=9 OR X=5 OR X=13 THEN RC=RC
    -V/40
413 RC=RC-V/40:GOTO 440
414 RC=RC+V/40:GOTO 440
420 X=STICK(1):IF X=10 OR X=14 OR X=
    6 THEN VD=VD+1:IF VD>5 THEN VD=5
422 IF X=9 OR X=5 OR X=13 THEN VD=VD
    -1:IF VD<-5 THEN VD=-5
440 IF VD<-5 THEN VD=-5
442 IF VD>5 THEN VD=5
444 IF RC>25 THEN RC=25
446 IF RC<-25 THEN RC=-25
450 IF A=0 THEN 452
451 A=A+RC:IF A>1800 THEN A=1800
452 AD=(D)*0.06:IF PR=1 THEN 460
453 IF ABS(A-AD)<30 THEN GP=0:GOTO 4
    60
454 GP=-(A-AD)/30
455 IF GP>8 THEN GP=8
456 IF GP<-8 THEN GP=-8
459 CR=CR-5
460 DV=FS*V*TD:D=D-DV
470 V=V+VD:IF V>300 THEN V=300
471 IF A<0 THEN A=0:FOR I=1 TO 70:SO
    UND 0,21,8,14:NEXT I:SETCOLOR 2,
    13,4
472 IF A>0 THEN 480
473 IF RC<-4 THEN B$="Excessive clim
    b rate (-4) CRASHED":GOTO 500
475 V=V+VD-3:RC=0:IF V<1 THEN 600
480 COLOR 0:PLOT 15,60:DRAWTO XD,YD
481 COLOR 1:I=D/DZ-90:GOSUB 999:PLOT
     15,60:DRAWTO X+15,Y+60:XD=X+15:
    YD=Y+60
482 COLOR 0:PLOT 147,60:DRAWTO XA,YA
483 COLOR 1:I=A/AZ-90:GOSUB 999:PLOT
     147,60:DRAWTO X+147,Y+60:XA=X+1
    47:YA=Y+60
```

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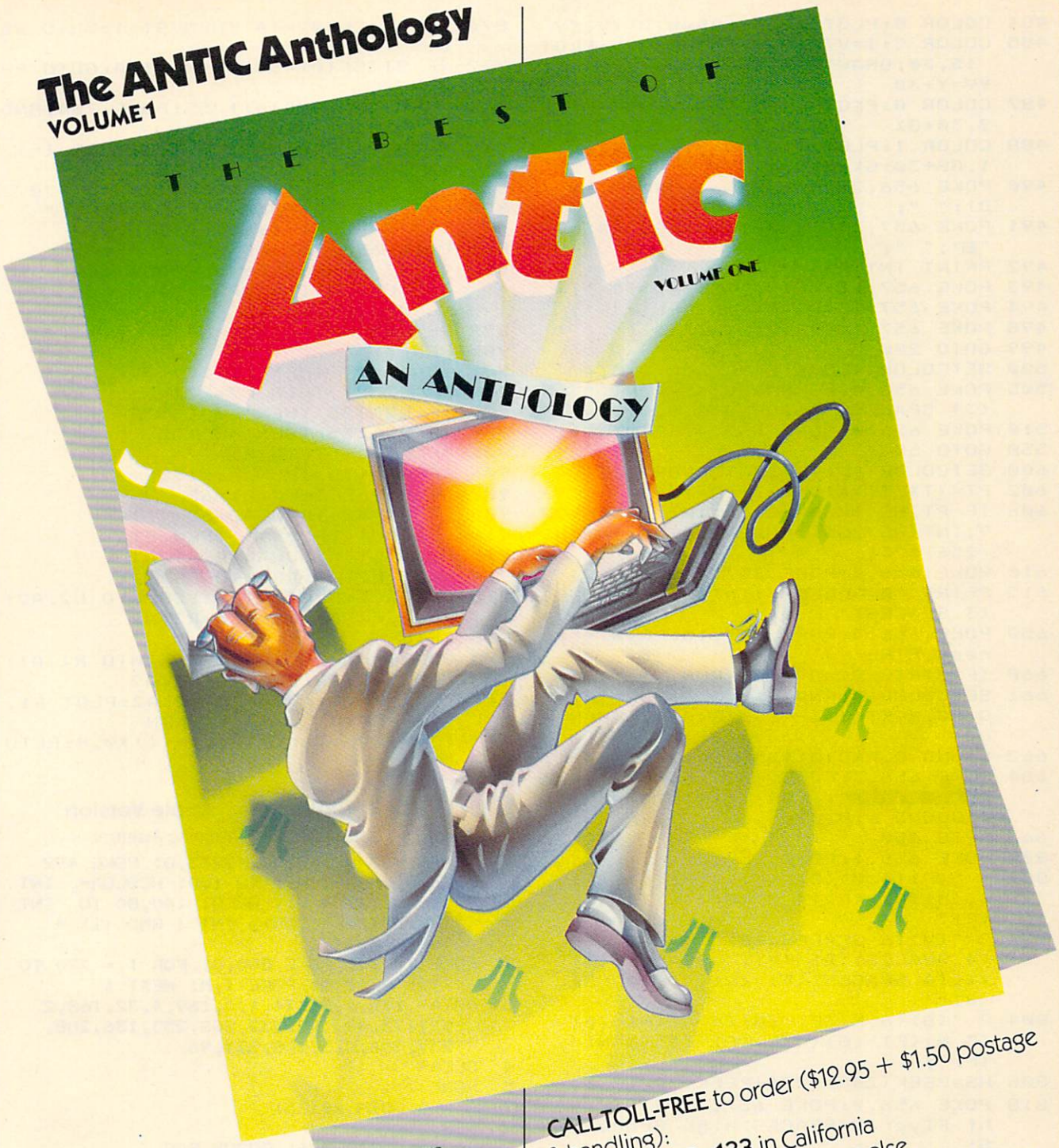

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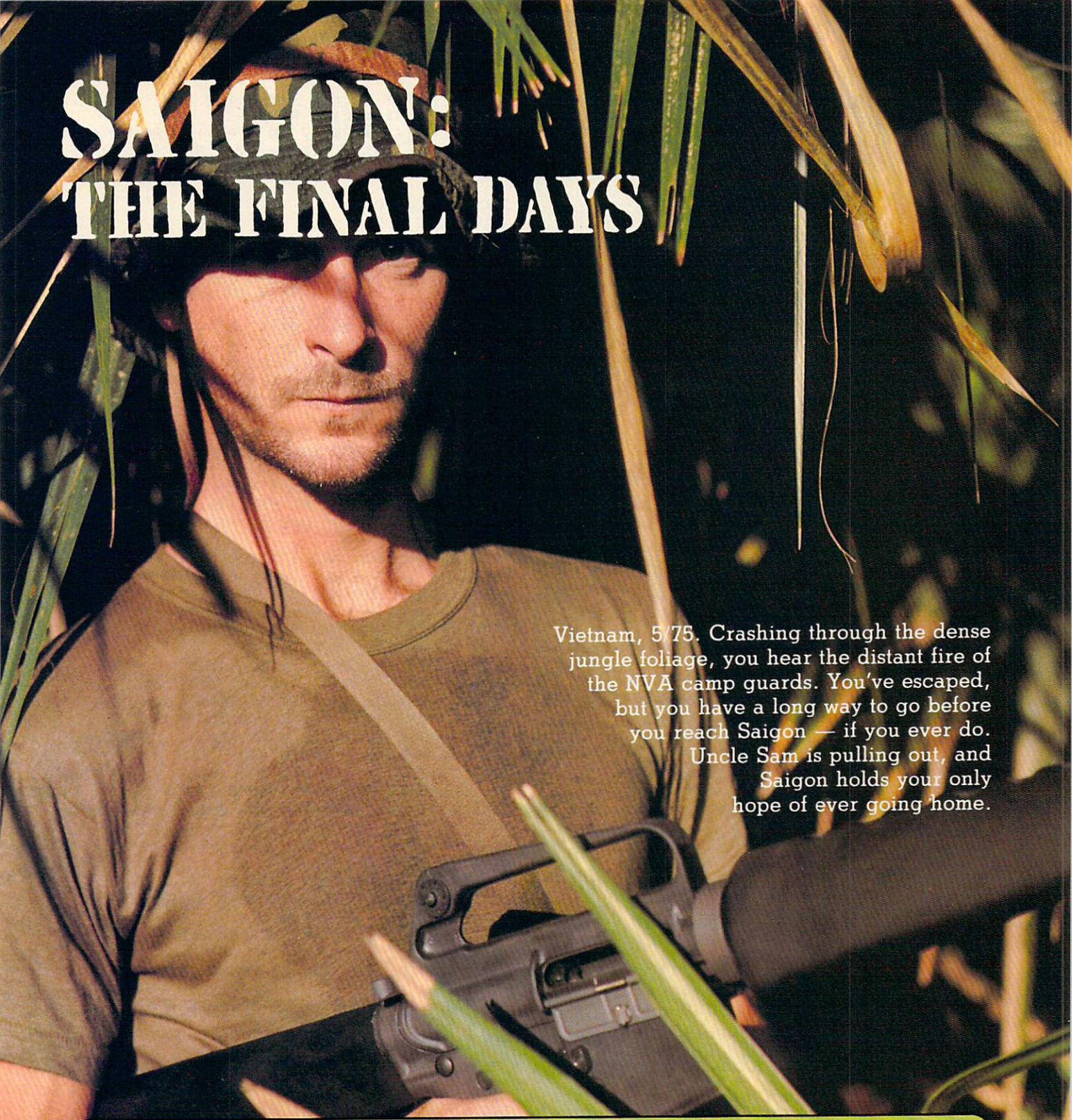
```
484 COLOR 0:PLOT 15,30:DRAWTO XV,YV
485 COLOR 2:I=V/VZ-90:GOSUB 999:PLOT
    15,30:DRAWTO X+15,Y+30:XV=X+15:
    YV=Y+30
487 COLOR 0:PLOT 142,30+GX:DRAWTO 15
    2,30+GX
488 COLOR 1:PLOT 143,GP+30:DRAWTO 15
    1,GP+30:GX=GP
490 POKE 656,2:POKE 657,3:PRINT INT(
    D);" ";
491 POKE 657,33:IF A<100 THEN PRINT
    "*";" ";
492 PRINT INT(A);" ";
493 POKE 657,13:PRINT INT(VD);" ";
494 POKE 657,25:PRINT INT(RC);" ";
498 POKE 657,19:PRINT INT(TI);
499 GOTO 200
500 SETCOLOR 4,5,4:SETCOLOR 2,5,4
505 POKE 656,0:POKE 657,3:PRINT "
    {34 SPACES}";:SOUND 0,0,0,0
510 POKE 656,0:POKE 657,4:PRINT B$;
550 GOTO 650
600 SETCOLOR 4,11,4:SETCOLOR 2,11,4
602 PT=(TX-TI)*10+D/2+CR+1000
606 IF PT>HS THEN HS=INT(PT):POKE 20
    9,INT(HS/256):POKE 208,HS-INT(HS
    /256)*256
610 POKE 656,0:POKE 657,4
615 PRINT " SCORE ";INT(PT);"
    {3 SPACES}"
650 POKE 656,3:POKE 657,15:PRINT " P
    ress FIRE ";
660 IF STRIG(0)=0 THEN RUN
661 SETCOLOR 0,RND(0)*15,4:FOR I=1 T
    O 50:NEXT I:IF STRIG(0)=0 THEN R
    UN
662 SOUND 0,RND(0)*255,10,2
664 POKE 656,3:POKE 657,15:PRINT "P
    ress Fire ";:FOR I=1 TO 50:NEXT
    I:SOUND 0,0,0,0
666 GOTO 650
800 POKE 656,1:POKE 657,2
802 ? "{F}{6 M}{G} {F}{4 M}{G} {F}
    {3 M}{G} {F}{4 M}{G} {F}{6 M}
    {G}"
803 ? "{V}{6 SPACES}{B} {V}
    {4 SPACES}{B} {V}{3 SPACES}{B}
    {V}{4 SPACES}{B} {V}{6 SPACES}
    {B}"
804 ? "{G}{6 N}{F} {G}{4 N}{F} {G}
    {3 N}{F} {G}{4 N}{F} {G}{6 N}
    {F}";
806 HS=PEEK(209)*256+PEEK(208)
818 POKE 656,0:POKE 657,3:PRINT "Nig
    ht Flyer{9 SPACES}High Score ";H
    S;
820 R=11
822 FOR I=0 TO 360 STEP 5
824 X=R*COS(I):Y=R*SIN(I)*0.9
825 COLOR 2:PLOT X+15,Y+60:PLOT X+14
    7,Y+60
826 COLOR 1:PLOT X+15,Y+30:PLOT X+14
    7,Y+30
828 NEXT I
832 COLOR 1:PLOT 15,30:DRAWTO 26,30
833 COLOR 2:PLOT 15,30:DRAWTO 15,20
834 PLOT 137,30:DRAWTO 140,30:PLOT 1
    54,30:DRAWTO 157,30
836 PLOT 15,60:DRAWTO 15,50:PLOT 147
    ,60:DRAWTO 147,50
860 POKE 656,0:POKE 657,3
862 PRINT "Random <L> or Standard <D
    > START ?";
870 IF STICK(0)=14 THEN ST=1:GOTO 88
    0
872 IF STICK(0)=13 THEN ST=0:GOTO 88
    0
874 POKE 705,RND(0)*255:POKE 704,RND
    (0)*255
875 SOUND 0,RND(0)*255,10,2:FOR I=1
    TO 20:NEXT I
876 FOR I=1 TO 100:NEXT I:GOTO 870
880 POKE 656,0:POKE 657,3:PRINT "
    {34 SPACES}";:SOUND 0,0,0,0
881 POKE 656,0:POKE 657,2
882 ? "{3 SPACES}Ds{6 SPACES}dV
    {5 SPACES}T{5 SPACES}dA
    {6 SPACES}A1";
899 RETURN
900 REM
901 IF L1<27 THEN L1=27
902 IF L2<27 THEN L2=27
903 IF L2>135 THEN L2=135
904 IF R2>135 THEN R2=135
905 IF R1<27 THEN R1=27
906 IF R1>135 THEN R1=135
907 IF A1>65 THEN A1=65
908 IF A2>65 THEN A2=65
910 COLOR 1:IF PR=1 THEN 914
912 PLOT L1,A1:DRAWTO R1,A1
914 PLOT L2,A2:DRAWTO R2,A2
915 COLOR 2:PLOT L1,A1:DRAWTO L2,A2:
    PLOT R1,A1:DRAWTO R2,A2
918 RETURN
920 COLOR 0:PLOT L1,A1:DRAWTO R1,A1:
    PLOT L2,A2:DRAWTO R2,A2
922 PLOT L1,A1:DRAWTO L2,A2:PLOT R1,
    A1:DRAWTO R2,A2:RETURN
999 X=10*COS(I):Y=10*SIN(I)*0.9:RETU
    RN
```

Program 2: Nightflyer — Apple Version

Translation by Kevin Martin, Programming Assistant

```
1  HOME : HGR2 : POKE 49233,0: POKE 492
     36,0: FOR I = 1 TO 100: HCOLOR=  INT
     ( RND (1) * 8): HPLOT 140,80 TO  INT
     ( RND (1) * 280), INT ( RND (1) *
     160): NEXT I
2  POKE 799,0: POKE 800,0: FOR I = 770 TO
     795: READ M: POKE I,M: NEXT I
3  DATA  172,1,3,174,1,3,169,4,32,168,2
     52,173,48,192,232,208,253,136,208,
     239,206,0,3,208,231,96
4  CLEAR
5  HOME
7 HS = 0: DIM B$(35)
8  HGR
9 DEG = .017452406: GOSUB 800
50 SH = 160:SW = 280:RL = 4000:RW = 60
52 T = 2: REM T IS DIST PILOT TO SCRN
54 FS = 66 / 45: REM  FT/SEC
90 LD = 0:KI = 80:VZ = 0.85:DZ = 100:AZ
     = 5:XV = 30:YV = 80:GX = 0:XD = 3
     0:YD = 120:XA = 250:YA = 120
100 D = 15000 +  RND (1) * 15000
102 A = 900 +  RND (1) * 900
103  IF ST = 0 THEN D = 20000:A = 1200
105 TX = D / 150
130 RC = 0:V = 200:PR = 0:CR = 0
140 BD = 0:BA = 0
150 RL = 4000:RW = 60
200  REM
208  IF PR = 0 AND D < 4000 AND A > 100
     0 THEN B$ = "ALTITUDE TOO HIGH FOR
      SAFE LANDING": GOTO 500
```



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Apple Version Notes For Nightflyer

Kevin Martin, Editorial Programmer

The Apple version of "Nightflyer" requires either game paddles or a joystick. If you are using paddles, control the plane's altitude (delta altitude or dA) by turning paddle 1. Likewise, control the plane's velocity (delta velocity or dV) by rotating paddle 0. On the other hand, if you use a joystick, follow the directions provided with the Atari version.

Landing the plane successfully takes practice and is quite challenging. Be sure to carefully read the details in the article on landing and scoring. To score the most points, you must touch down safely and stop the plane before you reach the end of the runway. Your overall score is based on the time of flight, your ability to hold the plane on the glide path, and the distance you are from the end of the runway when the plane stops.

The program sets up a crash sequence on the second high-resolution graphics page (line 1). The text and second high-resolution screen are first cleared. Then, using two POKEs, program control is transferred to the blank text screen so that you don't see what is being plotted. Later on, if you crash, the program quickly flips between the two high-resolution pages to simulate the crash (lines 520 – 526).

The sound routines for Nightflyer are POKEd into memory in line 2. The program stores the frequency of the sound in location 769 and its length in location 768. This routine produces the random notes at the beginning and end of each play. It also provides the crash sound (line 515) and the sound that is heard when the plane touches down.

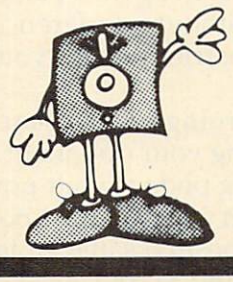
```
210  IF A > 1 AND V < 80 THEN B$ = "VEL
     OCITY BELOW STALL LEVEL (80)": GOTO
     500
211  IF A < 30 AND PR = 0 THEN B$ = "AL
     TITUDE BELOW MINIMUM (30)": GOTO 5
     00
212  IF D < 1 AND PR = 0 THEN D = 4000:
     PR = 1
213  IF D < 1 THEN B$ = "CRASHED AT THE
      END OF RUNWAY.": GOTO 500
214  IF PR = 1 THEN 300
215 X =  INT (D / 1000): IF X < 4 THEN
     218
216  IF X >  = KI THEN 400
218 KI = X: GOSUB 920
220 A1 = T * A / D * SH:A2 = ((T * A) /
     (D + RL)) * SH
230 RF = T * RW / D * SW:L1 = (SW - RF)
     / 2:R1 = L1 + RF
240 RR = ((T * RW) / (D + RL)) * SW:L2 =
     (SW - RR) / 2:R2 = L2 + RR
248  IF D < 4000 THEN  GOSUB 900: GOTO
     400
250  GOSUB 900
260  GOTO 400
300  GOSUB 920
310 A1 = 160:A2 = ((T * A) / D) * SH: IF
     A2 < 1 THEN A2 = 1
315  IF A < RF THEN RF = RF + 1: IF RF >
     278 THEN RF = 278
316  IF A > RF THEN RF = RF - 1: IF RF <
     RR THEN RF = RR + 7
320 L1 = (SW - RF) / 2:R1 = L1 + RF
325 RR = ((T * RW) / (D)) * SW:L2 = (SW
     - RR) / 2:R2 = L2 + RR
330  GOSUB 900
350  IF A > D / 10 THEN B$ = "ALTITUDE
     TOO HIGH FOR SAFE LANDING": GOTO 5
     00
400 T1 = TI:TI = TI + 1:TD = TI - T1
403 X =  PDL (0):Y =  PDL (1): IF Y > 5
     0 AND Y < 200 AND X > 50 AND X < 2
     00 THEN 450
405  IF X > 200 AND Y > 200 THEN VD = V
     D + 1:RC = RC - V / 40: GOTO 440
406  IF X > 200 AND Y < 50 THEN VD = VD
      + 1:RC = RC + V / 40: GOTO 440
407  IF X > 200 AND Y > 50 AND Y < 200 THEN
     VD = VD + 1: GOTO 440
409  IF X < 50 AND Y > 200 THEN VD = VD
      - 1:RC = RC - V / 40: GOTO 440
410  IF X < 50 AND Y < 50 THEN VD = VD -
     1:RC = RC + V / 40: GOTO 440
411  IF X < 50 AND Y > 50 AND Y < 200 THEN
     VD = VD - 1: GOTO 440
413  IF X > 50 AND X < 200 AND Y > 200 THEN
     RC = RC - V / 40: GOTO 440
414  IF X > 50 AND X < 200 AND Y < 50 THEN
     RC = RC + V / 40: GOTO 440
440  IF VD <  - 5 THEN VD =  - 5
442  IF VD > 5 THEN VD = 5
444  IF RC > 25 THEN RC = 25
446  IF RC <  - 25 THEN RC =  - 25
450  IF A = 0 THEN 452
451 A = A + RC: IF A > 1800 THEN A = 18
     00
452 AD = (D) * 0.06: IF PR = 1 THEN 460

453  IF  ABS (A - AD) < 30 THEN GP = 0:
      GOTO 460
454 GP =  - (A - AD) / 30
455  IF GP > 12 THEN GP = 12
456  IF GP <  - 12 THEN GP =  - 12
459 CR = CR - 5
460 DV = FS * V * TD:D = D - DV
470 V = V + VD: IF V > 300 THEN V = 300

471  IF A < 0 THEN A = 0
472  IF A > 0 THEN 480
473  IF RC <  - 4 THEN B$ = "EXCESSIVE
     CLIMB RATE (-4) CRASHED": GOTO 500

475 V = V + VD - 3:RC = 0: IF V < 1 THEN
     600
476  IF LD = 0 THEN LD = 1: FOR I = 1 TO
     10: POKE 768,1: POKE 769,1: CALL 7
     70: NEXT
480  HCOLOR= 0: HPLOT 30,120 TO XD,YD
481  HCOLOR= 3:I = D / DZ - 90: GOSUB 9
```

```
    99: HPLOT 30,120 TO X + 30,Y + 120
    :XD = X + 30:YD = Y + 120
482 HCOLOR= 0: HPLOT 250,120 TO XA,YA
483 HCOLOR= 3:I = A / AZ - 90: GOSUB 9
    99: HPLOT 250,120 TO X + 250,Y + 1
    20:XA = X + 250:YA = Y + 120
484 HCOLOR= 0: HPLOT 30,80 TO XV,YV
485 HCOLOR= 3:I = V / VZ - 90: GOSUB 9
    99: HPLOT 30,80 TO X + 30,Y + 80:X
    V = X + 30:YV = Y + 80
487 HCOLOR= 0: HPLOT 241,80 + GX TO 25
    9,80 + GX
488 HCOLOR= 3: HPLOT 241,GP + 80 TO 25
    9,GP + 80:GX = GP
490 VTAB 23: HTAB 5: PRINT  INT (D);"
    ";
491 HTAB 31: IF A < 100 THEN  INVERSE
    : PRINT "*";: NORMAL : PRINT " ";
492 PRINT  INT (A);" ";
493 HTAB 15: PRINT  INT (VD);" ";
494 HTAB 24: PRINT  INT (RC);" ";
498 HTAB 19: PRINT  INT (TI);
499 GOTO 200
500 REM
505 VTAB 21: HTAB 3: PRINT "
                           "
510 VTAB 21: HTAB 4: PRINT B$;
515 FOR I = 1 TO 10: POKE 768,1: POKE
    769,10: CALL 770: NEXT
520 FOR I = 1 TO 50
525 POKE 49234,0: POKE 49237,0: POKE 4
    9236,0: POKE 49235,0
526 NEXT I
550 GOTO 650
600 REM
602 PT = (TX - TI) * 10 + D / 2 + CR +
    1000
606 IF PT > HS THEN HS =  INT (PT): POKE
    800, INT (HS / 256): POKE 799,HS -
     INT (HS / 256) * 256
610 VTAB 21: HTAB 4
615 PRINT "SCORE "; INT (PT);"   "
650 VTAB 24: HTAB 13: PRINT "PRESS BUT
    TON 0";
655 POKE 769, RND (1) * 254 + 1: POKE
    768,3: CALL 770
660 IF  PEEK ( - 16287) > 127 THEN 4
661 FOR I = 1 TO 250: NEXT I: IF  PEEK
    ( - 16287) > 127 THEN 4
662 POKE 769, RND (1) * 254 + 1: POKE
    768,3: CALL 770
664 HTAB 13: INVERSE : PRINT "PRESS BU
    TTON 0";: NORMAL : FOR I = 1 TO 25
    0: NEXT I
666 GOTO 650
800 VTAB 22: HTAB 4
802 PRINT "/------"; CHR$ (92);"/----"
    ; CHR$ (92);"/---"; CHR$ (92);"/--
    --"; CHR$ (92);"/------"; CHR$ (92
    )
803 HTAB 4: PRINT "!       !!     !!    !
    !     !!       !"
804 HTAB 4: PRINT  CHR$ (92);"------/"
    ; CHR$ (92);"----/"; CHR$ (92);"--
    -/"; CHR$ (92);"----/"; CHR$ (92);
    "------/";
806 HS =  PEEK (800) * 256 +  PEEK (799
    )
818 VTAB 21: HTAB 4: PRINT "NIGHT FLYE
    R          HIGH SCORE ";HS;
820 R = 19
822  FOR I = 0 TO 360 STEP 3
824 X = R *  COS (I * DEG):Y = R *  SIN
    (I * DEG) * .9
825 HCOLOR= 3: HPLOT X + 30,Y + 120: HPLOT
    X + 250,Y + 120
826 HCOLOR= 3: HPLOT X + 30,Y + 80: HPLOT
    X + 250,Y + 80
828 NEXT I
832 HCOLOR= 3: HPLOT 30,80 TO 47,80
833 HCOLOR= 3: HPLOT 30,80 TO 30,63
834 HPLOT 232,80 TO 240,80: HPLOT 260,
    80 TO 268,80
836 HPLOT 30,120 TO 30,102: HPLOT 250,
    120 TO 250,102
860 VTAB 21: HTAB 3
862 PRINT "RANDOM <";: INVERSE : PRINT
    "U";: NORMAL : PRINT "> OR STANDAR
    D <";: INVERSE : PRINT "D";: NORMAL
    : PRINT "> START ?    ";
870 IF  PDL (1) < 50 THEN ST = 1: GOTO
    880
872 IF  PDL (1) > 210 THEN ST = 0: GOTO
    880
875 POKE 769, RND (1) * 254 + 1: POKE
    768,3: CALL 770
876 GOTO 870
880 VTAB 21: HTAB 3: PRINT "
                           ";
881 VTAB 21: HTAB 4
882 PRINT "   DS     DV    T    DA
     AL";
899 RETURN
900 REM
901 IF L1 < 50 THEN L1 = 50
902 IF L2 < 50 THEN L2 = 50
903 IF L2 > 230 THEN L2 = 230
904 IF R2 > 230 THEN R2 = 230
905 IF R1 < 50 THEN R1 = 50
906 IF R1 > 230 THEN R1 = 230
907 IF A1 > 160 THEN A1 = 160
908 IF A2 > 160 THEN A2 = 160
910 HCOLOR= 3: IF PR = 1 THEN 914
912 HPLOT L1,A1 TO R1,A1
914 HPLOT L2,A2 TO R2,A2
915 HCOLOR= 3: HPLOT L1,A1 TO L2,A2: HPLOT
    R1,A1 TO R2,A2
918 RETURN
920 HCOLOR= 0: HPLOT L1,A1 TO R1,A1: HPLOT
    L2,A2 TO R2,A2
922 HPLOT L1,A1 TO L2,A2: HPLOT R1,A1 TO
    R2,A2: RETURN
999 X = 17 *  COS (I * DEG):Y = 17 *  SIN
    (I * DEG) * .9: RETURN
```

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Space Thief

Steve Low

The survival of two neighboring space civilizations depends on their ability to smuggle power pods, but they must cross through the megabarrier. This two-player game involves both an offensive and defensive strategy. Written for the Atari, a 64 version is included. Two joysticks are required.

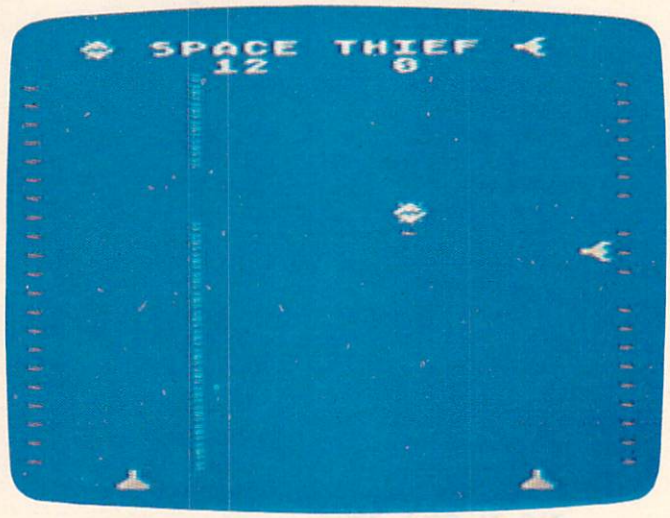
For eons the Alpha and Zeta civilizations have coexisted with a mutual trade agreement. Each uses an energy station dependent upon a combination of power pods from both sides. An undeclared war has negated this treaty.

To maintain your energy base, pods must be smuggled from the adjoining nation and deposited at your station for processing. Load the pods by docking your cargo ship next to them and pressing the joystick trigger. The pods can be destroyed when the ship carrying them either strikes the megabarrier or is shot by an enemy ship. Your cargo ships are unharmed by shots from a laser cannon. Pass pods through the correct power plant to unload.

As starship commander, you must also defend your native pods from capture. For this defensive necessity, your cargo ship has been equipped with a unidirectional laser cannon.

Making transportation difficult is the megabarrier, a barricade which constantly relocates but always leaves an area open. You may pass through the opening without interference; however, crashing into the barrier returns your ship to its starting location.

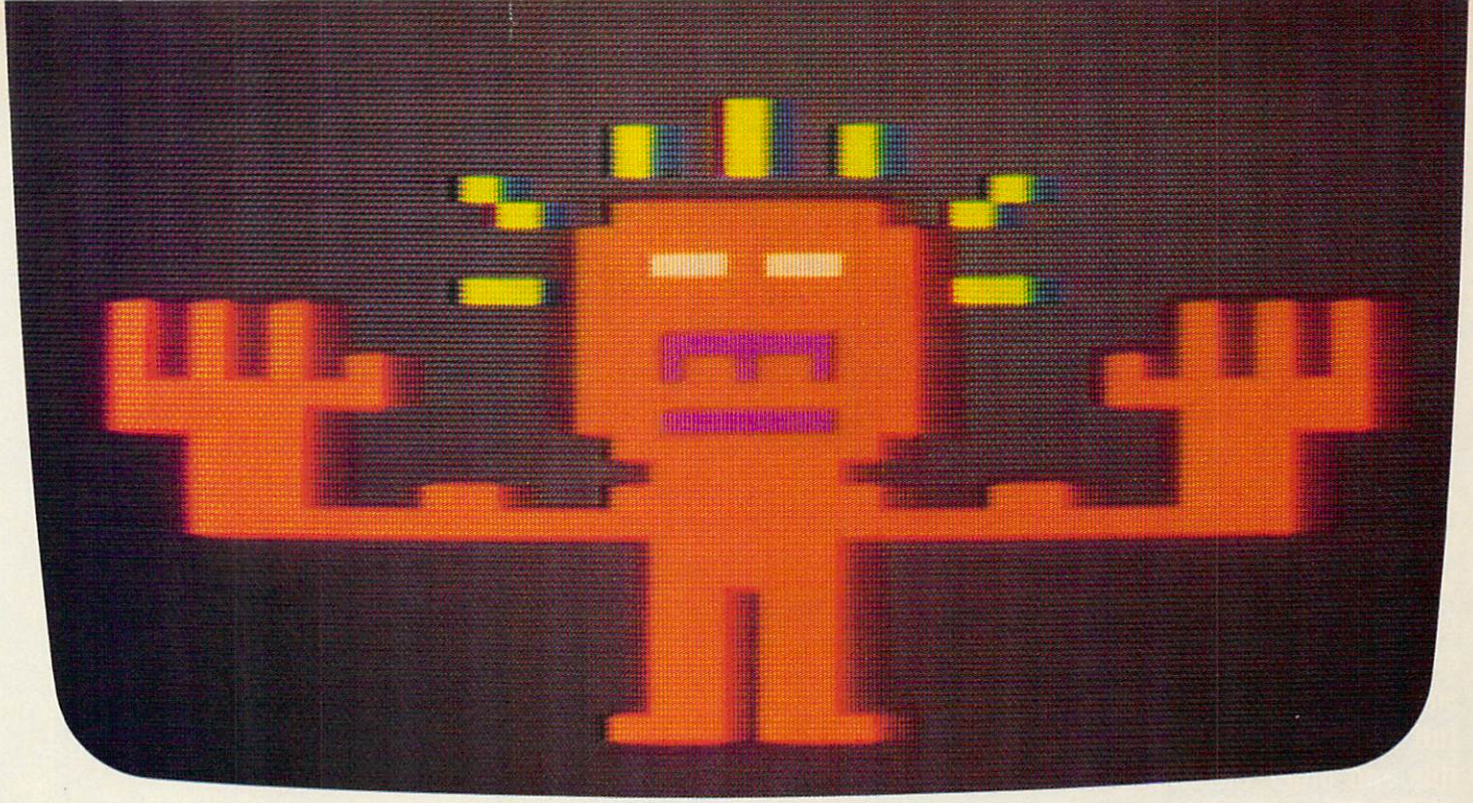
The game is won by accruing points. You receive two points for blasting your opponent and five points for depositing pods at your power station. The game terminates when the last pod from either civilization is deposited safely or lost. Replay is initialized by pressing START.



Player 1 has captured the opponent's pod in "Space Thief." Atari version.

Program 1: Space Thief — Atari Version

```
150 DIM UD(15),RL(15)
160 GRAPHICS 17:SETCOLOR 0,2,10:SETC
    OLOR 4,8,3
170 POSITION 4,7:? #6;"SPACE THIEF"
200 FOR DEL=1 TO 750:NEXT DEL
210 GRAPHICS 17:SCREEN=PEEK(88)+256*
    PEEK(89)
220 SETCOLOR 0,2,10:SETCOLOR 1,3,8:S
    ETCOLOR 2,12,6:SETCOLOR 3,3,4:SE
    TCOLOR 4,8,3
230 REM Check for initilazation
240 CHSET=(PEEK(106)-8)*256
250 IF PEEK(CHSET+10)=24 THEN POKE 5
    59,0:GOTO 300
260 POKE 559,34:POSITION 6,10:? #6;"
    PLEASE":POSITION 7,13:? #6;"WAIT
    "
270 FOR DEL=1 TO 750:NEXT DEL
280 POSITION 6,10:? #6;"{6 SPACES}":
    POSITION 7,13:? #6;"{4 SPACES}"
290 POKE 559,0:GOSUB 1600
300 POKE 756,PEEK(106)-8
```



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It looks like Santa may just miss Christmas this year. Since the exciting games from **MMG Micro Software** (for the ATARI, APPLE and COMMODORE systems) have arrived, he hasn't been able to tear himself away from his terminal long enough to fill his sacks. He's playing FINAL FLIGHT!—a thrilling flight simulator set in a descending aircraft surrounded by tricky weather conditions with full instrumentation and many options. To play this and other thrilling games from **MMG Micro Software**, you need a combination of skill, strategy and speed. So ask Santa for MMG Micro Software games this year. On second thought, maybe you'd better go out and buy them yourself—it looks like it could be a long wait.

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Great Games from MMG!

FINAL FLIGHT!

Imagine yourself at the controls of a small, single engine plane, 10,000 feet in the air, on your final approach to the runway and safety. You're running low on fuel, but your instruments show that you're on the glide path, and lined up with the runway. It's a beautiful, sunny day, and you can see the airport in the distance, across the grassy fields. But the crosswind is tricky, there are other planes in the air, and it will take all your skill to land safely. You're coming down now, and the runway is getting closer. A bit left, OK, now lower the power, fine, now put down the landing flaps. Pull the nose up a bit more, you're a little low. Watch the power! Don't stall! OK. Here comes the runway. Your pulse quickens, and finally you hear the squeal of your tires on the pavement. You're down, but watch it, you're pulling right! Brakes! Brakes! Left more! OK, you've stopped, you've landed safely. Good job!

The first real-time flight and landing simulator for the ATARI and COMMODORE is now available from MMG Micro Software. Written entirely in machine language, there are four levels of difficulty, and you may choose clear or foggy weather, with or without instruments, and with or without the real-time view from the cockpit. Multiple screen updates per second give a realistic feel of flying. Disk or tape available for COMMODORE and ATARI.

24K $29.95

TIMBER! NEW!

TIMBER! is an action-packed arcade style game with multiple levels of play and difficulty. You're Blackjack Daniels, the greatest lumberjack that ever set foot into an ATARI computer! Imagine yourself in the deep dark forest chopping down trees for the Upland Logging Corporation. Your boss has sent you on a very important mission and your job depends on the successful completion of that mission. You are to clear the forest, chopping down trees into cords so that the logging trucks may easily transport them to the mill.

But things aren't as rosy as you thought they might be. You've noticed several forest creatures looking at you as you're trying to meet your logging deadline. Some of them are downright unfriendly looking! You quickly realize that you will be short of your quota of trees in this area, and you'll need to move on to a new woodland area to get enough trees downed. But, everywhere you turn, you see snakes, bears, and other forest creatures. To top everything off, your ax is getting dull and you're finding out that you must hit the "sweet" part of the tree to make it fall.

Time is running out! You must race on to meet the deadline. You quickly enter a mole hole as a snake is about to strike and find out that it comes out in another part of the forest. In fact, there are mole holes all around you and by jumping into them, you find shortcuts to other parts of the forest.

You can't swim and the river is flowing rapidly. You know that your only way to get to the trees on the other side of the river is to cross the bridge. You look around. Oh! Here comes a bear. You quickly cross the bridge and you're temporarily saved from the bear.

By the way, I'm the boss now and I need someone to perform an emergency mission for me. Will you be brave enough to try it? TIMBER! is all machine language. Requires 40K RAM, a disk drive and 1 joystick. Disk only for ATARI.

40 K $29.95

THE ABRAXAS ADVENTURE SERIES No. 1: NEW!

Assault On The Astral Rift

First Program of the New ABRAXAS Series

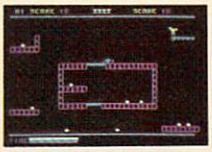
Adventure enthusiasts, take heart! The ultimate adventure series has arrived, from MMG Micro Software. ASSAULT ON THE ASTRAL RIFT is the first in the new ABRAXAS Adventure series and you'll not soon tire of its many challenges. It's a multiplayer adventure, also playable by a single player, with graphics and music unlike any seen or heard before. Imagine, really being able to read minds, to think in totally foreign languages, and to work together toward the ultimate goal of saving our universe. Imagine an adventure game different with each play. Isn't this why you bought your computer?

You are a member of a small, select band of people with a crucial secret, charged with the responsibility of maintaining the universe as we know it. One of your group has discovered the existence of alternate universes, populated by creatures known on Earth only by our legends. Far worse was the discovery that some of them have learned to travel between the many universes, and, in doing so, have weakened the fabric of our universe. They must be stopped, and you and your comrades are the only ones who can do it!

Your quest begins in a huge stone castle recently converted to a hotel. The guests left abruptly when strange occurrences began, but you know the real nature of these strange events. Time is crucial, and you'll have to begin your journey now. The time holes have begun to open, the first sign of the weakening of the fabric of our universe!

This first program in the ABRAXAS Adventure Series, ASSAULT ON THE ASTRAL RIFT, requires 48K and 1 disk drive. Available on disk only for ATARI.

48K $39.95



Phoenix Lair NEW!

PHOENIX LAIR is an arcade style game comprised of 10 boards and 10 speed levels. It is unlike any game on the market today. Multiple strategies, an interlude jousting challenge between boards, bright and lively colors and music add to the already superb play of this completely unique and different game. Game Play: The game begins at board one and advances to higher boards after successful completion. Many obstacles are encountered on the various boards as points are accumulated. At the beginning of each board, the Phoenix must leave its lair in search of enemy eggs. The Phoenix flight is controlled in height by the joystick button, and in direction by the joystick itself. After successfully destroying at least six of these eggs the Phoenix must return to the far right side of its lair. Points are awarded based on the total number of eggs destroyed and the time in which it took to complete the mission. A fast mission will result in additional bonus points. You begin with 5 lives and gain additional lives at boards 7, 9 and 10. PHOENIX LAIR is all machine language. Requires 40K RAM, a disk drive and 1 joystick. Disk only available for COMMODORE and ATARI.

40K $29.95

Rat Race NEW!

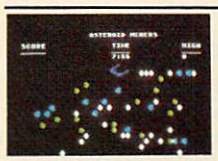
RAT RACE is an action packed arcade-style game with multiple levels of difficulty and challenge. Colorful graphics and superb music enhance the excitement of the game.

Picture yourself in a fast food restaurant. The restaurant is so busy that as soon as food is prepared, the chef just throws it wherever he has room. The restaurant is obviously very messy and in much confusion! Your job is to gather the food for the orders and place it into the proper bin on top of the screen. The french fries go into the french fry bin, the hamburgers into their own bin, and so on.

Sounds simple, doesn't it? Just gather the food and put it into the appropriate bin. But you know better than that, don't you? There are a few minor problems. Since the food is all over the place, some of the local rats have found the restaurant a very attractive place to hang out for lunch, since it is always so sloppy! Generally, they restrict their activities to certain areas of the screen, but they're so fast, it's a race for your life. If they bite you, you'll begin again with one fewer life. The excitement mounts as the degree of difficulty builds. After you've cleared a few boards, you'll see the infamous super rat, who races anywhere with only one thing in mind—to get you! RAT RACE is all machine language. Requires 40K RAM, 1 disk drive and 1 joystick. Disk only for ATARI.

40K $29.95

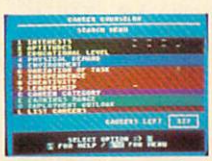
Programs That Teach from MMG



Asteroid Miners

ASTEROID MINERS—A UNIQUE GAME TUTORIAL—is truly that. A 32K game written in BASIC with numerous machine language subroutines, it has 3 levels of difficulty. At the easiest level, it's a race against time; at the hardest, strategy and speed are both critical. Can you beat the high score before time runs out? Get the valuable asteroids, but avoid the duds. Above all, BE CAREFUL! One mistake, and well...ASTEROID MINERS comes with a 50-page book which completely explains every line of the program. The source codes for the BASIC and assembly language programs are included, and fully explained. See how these advanced functions are implemented in a working game! You'll learn machine language routines to relocate the character set, zero the player-missile graphics area of memory, move players, and to put a countdown timer on the screen. Use these routines in your own programs! Every aspect of the program is described in detail, from redefining character sets, to creating multicolored and multifunctional players, to multiprocessing using the vertical blank interrupt. Music, extensive sound and color graphics—in short, a complete tutorial on the advanced functions YOU can use with your ATARI! Disk or tape for ATARI only.

32K $34.95



MMG CAREER COUNSELOR

A unique and fascinating way to explore the important world of careers. Take the first steps toward discovering the careers that are right for you. It is designed to be used at home, in schools, or in libraries by a wide variety of people. The "Career Search" technique used in the program provides a combination of education, fun, and a sense of adventure, making it as valuable for adults as it is for students.

You enter your likes and dislikes concerning interests, abilities, nature of work and other goals through a set of easy to use menus and displays. The program will generate a list of careers which satisfies your preferences. Through repeated use of the "Career Search" process you gain valuable, life-long insights into your career goals and the hundreds of careers stored by the program

The program also features a "Career Dictionary," which is another source of clear, concise information. This feature allows you to quickly and easily obtain descriptions of all the desired careers. Disk only available for ATARI.

32K $59.95 - Expanded APPLE version available on disk only requires **48K $129.95**

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```
310 XPL1=1:XPL2=18:YPL1=11:YPL2=YPL1
320 BUMP1=YSCR+4:BUMP2=YSCR+4:B=0
330 TRS1=0:TRS2=0:PU1=0:PU2=0:SC1=0:
    SC2=0
340 REM The power pods @ screens edg
    e
350 FOR TRX=0 TO 19 STEP 19:FOR TRY=
    2 TO 22:POSITION TRX,TRY:? #6;"■
    ":NEXT TRY:NEXT TRX
360 GOSUB 1460
370 POSITION 4,0:? #6;"SPACE THIEF"
380 POSITION 2,0:? #6;"J":POSITION 1
    6,0:? #6;"K":POSITION 3,23:? #6;
    "w":POSITION 16,23:? #6;"w"
390 IF B=0 THEN GOSUB 990:B=1:POKE 1
    9,0:POKE 559,34
400 REM BEGIN MAIN BODY OF PROGRAM
410 REM Check for # of power pods pi
    cked up & therefore (RIGHT) end
    of game
420 IF PU1=21 OR PU2=21 THEN GOSUB 1
    480
430 REM ? Time to move mega-barrier
440 IF PEEK(19)>=2 THEN FOR ERS=2 TO
     23:POKE SCREEN+XSCR+20*ERS,0:NE
    XT ERS:GOSUB 990:POKE 19,0
450 ST0=STICK(0):ST1=STICK(1)
460 POKE SCREEN+463,119:POKE SCREEN+
    476,119:REM The Power stations
470 IF ST0<>15 THEN POKE SCREEN+XPL1
    +20*YPL1,0:IF TRS1=241 THEN POKE
     SCREEN+XPL1+20*(YPL1+1),0
480 IF ST0<>15 OR ST1<>15 THEN POKE
    53760,30:POKE 53761,164:POKE 77,
    0:REM Moving sound & disable 'at
    tract mode'
490 XPL1=XPL1+RL(ST0):YPL1=YPL1+UD(S
    T0)
500 REM Keep it in the borders
510 IF XPL1>17 THEN XPL1=18
520 IF XPL1<2 THEN XPL1=1
530 IF YPL1<3 THEN YPL1=2
540 IF YPL1>21 THEN YPL1=22
550 REM POKE player 1 to screen
560 POKE SCREEN+XPL1+20*YPL1,42:IF T
    RS1=241 THEN POKE SCREEN+XPL1+20
    *(YPL1+1),241
570 REM Check for mega-barrier colli
    sion
580 IF XPL1<>XSCR THEN 600
590 IF YPL1<=YSCR OR YPL1>=BUMP1 THE
    N ZAP=0:HIT=6:GOSUB 1090:IF TRS1
    =241 THEN PU1=PU1+1:TRS1=0
600 IF TRS1=241 THEN 660
610 REM Enable power pod pick-up
620 IF XPL1=18 AND STRIG(0)=0 THEN T
    RS1=PEEK(SCREEN+19+20*YPL1):IF T
    RS1=241 THEN BUMP1=YSCR+3:GOTO 6
    40
630 GOTO 660
640 POKE SCREEN+19+20*YPL1,0
650 REM Dropping off pow. pod
660 IF XPL1=3 AND YPL1=22 THEN POKE
    53761,0:GOTO 680
670 GOTO 720
680 IF TRS1=241 THEN SC1=SC1+5:GOSUB
     1460:FOR W=14 TO 0 STEP -2:SOUN
    D 0,W+10,10,W:NEXT W:GOTO 700
690 GOTO 710
700 TRS1=0:PU1=PU1+1
710 REM **Player 1 moved first,now P
    l.2 will get to shoot first **
720 IF STRIG(1)=0 AND XPL2<>1 THEN M
    X=XPL2-1:MY=YPL2:GOSUB 1330
730 POKE 53761,0
740 REM And now for player 2 to move
750 IF ST1<>15 THEN POKE SCREEN+XPL2
    +20*YPL2,0:IF TRS2=241 THEN POKE
     SCREEN+XPL2+20*(YPL2+1),0
760 XPL2=XPL2+RL(ST1):YPL2=YPL2+UD(S
    T1)
770 IF XPL2>17 THEN XPL2=18
780 IF XPL2<2 THEN XPL2=1
790 IF YPL2<3 THEN YPL2=2
800 IF YPL2>21 THEN YPL2=22
810 POKE SCREEN+XPL2+20*YPL2,43:IF T
    RS2=241 THEN POKE SCREEN+XPL2+20
    *(YPL2+1),241
820 IF XPL2<>XSCR THEN 840
830 IF YPL2<=YSCR OR YPL2>=BUMP2 THE
    N ZAP=1:HIT=6:GOSUB 1090:IF TRS2
    =241 THEN PU2=PU2+1:TRS2=0
840 IF TRS2=241 THEN 880
850 IF XPL2=1 AND STRIG(1)=0 THEN TR
    S2=PEEK(SCREEN+20*YPL2):IF TRS2=
    241 THEN BUMP2=YSCR+3:GOTO 870
860 GOTO 880
870 POKE SCREEN+20*YPL2,0
880 IF XPL2=16 AND YPL2=22 THEN 900
890 GOTO 930
900 IF TRS2=241 THEN SC2=SC2+5:GOSUB
     1460:FOR W=14 TO 0 STEP -2:SOUN
    D 0,W+10,10,W:NEXT W:GOTO 920
910 GOTO 930
920 TRS2=0:PU2=PU2+1
930 IF STRIG(0)=0 AND XPL1<>18 THEN
    MX=XPL1+1:MY=YPL1:GOSUB 1200
940 GOTO 420
950 REM END MAIN BODY OF PROGRAM
960 REM
970 REM SUBROUTINES
980 REM The Mega-barrier & window
990 XSCR=INT(RND(0)*16+2):YSCR=INT(R
    ND(0)*16+2)
1000 IF XSCR=XPL1 OR XSCR=XPL2 THEN
     990
1010 FOR A1=2 TO YSCR:POKE SCREEN+XS
    CR+20*A1,172:NEXT A1
1020 FOR A2=YSCR+4 TO 22:POKE SCREEN
    +XSCR+20*A2,172:NEXT A2
1030 BUMP1=YSCR+4:BUMP2=YSCR+4
1040 IF TRS1=241 THEN BUMP1=BUMP1-1
1050 IF TRS2=241 THEN BUMP2=BUMP2-1
1060 RETURN
1070 REM Explosion sound
1080 REM Notice HIT makes sound diff
    erent for collisions with wall
    vs. being shot
1090 DUR=6:PITCH=20
1100 SOUND 2,75,HIT,15:ICR=0.79+DUR/
    100
1110 V1=15:V2=15:V3=15
1120 SOUND 0,PITCH,HIT,V1:SOUND 2,PI
    TCH+20,HIT,V2:SOUND 3,PITCH+50,
    HIT,V3
1130 V1=V1*ICR:V2=V2*(ICR+0.05):V3=V
    3*(ICR+0.08)
1140 IF V3>4 THEN 1120
1150 FOR S=0 TO 3:SOUND S,0,0,0:NEXT
     S:IF HIT=6 THEN POKE 19,2
1160 IF HIT=8 THEN RETURN
1170 IF ZAP=0 THEN XPL1=1:YPL1=10:RE
    TURN
1180 IF ZAP=1 THEN XPL2=18:YPL2=10:R
```

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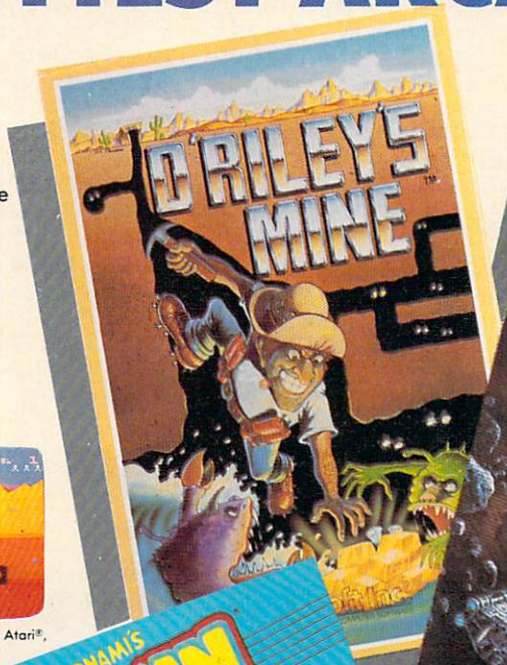

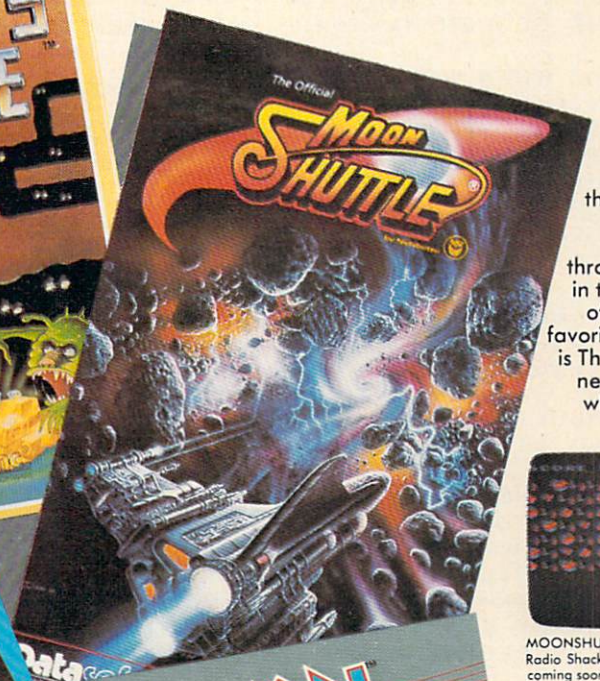

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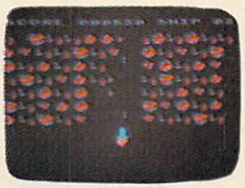
Your screen explodes with life-threatening action as you pilot your Moon Shuttle through outer space in this home version of the Nichibutsu® favorite. Awaiting you is The Prince of Darkness and his forces, which mysteriously multiply!



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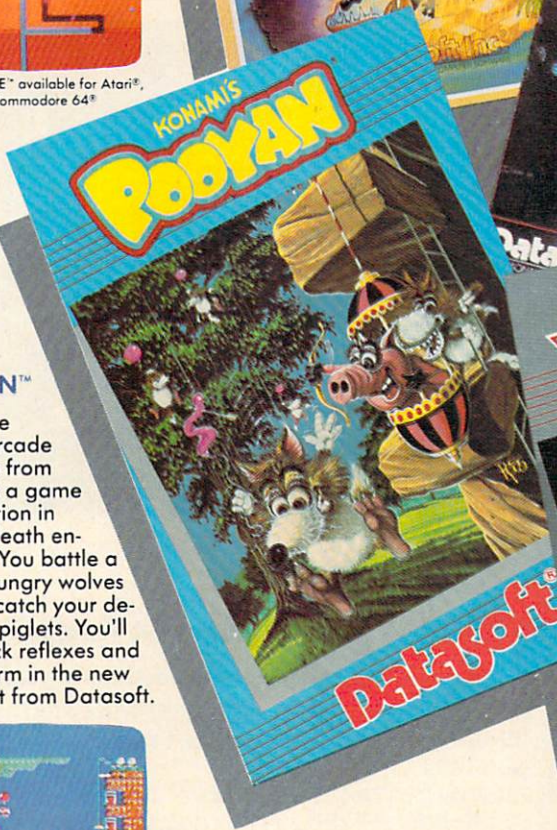

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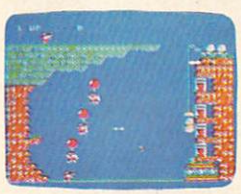
One of the biggest arcade game hits from Konami is a game of fast action in life-and-death encounters. You battle a pack of hungry wolves eager to catch your defenseless piglets. You'll need quick reflexes and a good arm in the new arcade hit from Datasoft.



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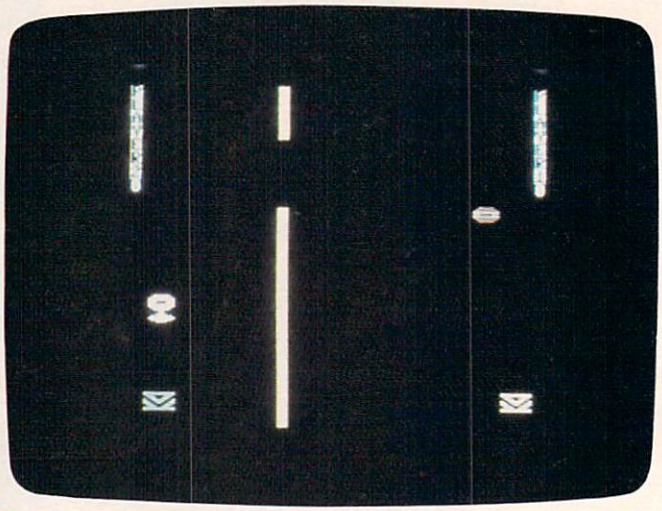
```
     ETURN
1190 REM Shooting subr pl 1
1200 POKE 53761,0:IF MX=19 THEN RETU
     RN
1210 H=PEEK(SCREEN+MX+20*MY):IF H=17
     2 THEN RETURN
1220 IF H=43 THEN POKE SCREEN+MX+20*
     MY,0:HIT=8:GOTO 1260
1230 POKE SCREEN+MX+20*MY,46:H=PEEK(
     SCREEN+(MX+1)+20*MY):IF H=44 TH
     EN POKE SCREEN+MX+20*MY,0:RETUR
     N
1240 IF H=43 THEN POKE SCREEN+(MX+1)
     +20*MY,0:HIT=8:GOTO 1260
1250 GOTO 1290
1260 POKE SCREEN+MX+20*MY,0:SC1=SC1+
     2:GOSUB 1460:IF TRS2=241 THEN P
     OKE SCREEN+XPL2+20*(MY+1),0:TRS
     2=0:PU2=PU2+1
1270 XPL2=18:YPL2=11:GOSUB 1090
1280 RETURN
1290 POKE SCREEN+MX+20*MY,0:MX=MX+1:
     IF MX=19 THEN RETURN
1300 GOTO 1200
1310 RETURN
1320 REM Shooting subr for pl 2
1330 POKE 53761,0:IF MX=0 THEN RETUR
     N
1340 H=PEEK(SCREEN+MX+20*MY):IF H=17
     2 THEN RETURN
1350 IF H=42 THEN POKE SCREEN+MX+20*
     MY,0:HIT=8:GOTO 1390
1360 POKE SCREEN+MX+20*MY,46:H=PEEK(
     SCREEN+(MX-1)+20*MY):IF H=3 THE
     N POKE SCREEN+MX+20*MY,0:RETURN

1370 IF H=42 THEN POKE SCREEN+(MX-1)
     +20*MY,0:HIT=8:GOTO 1390
1380 GOTO 1420
1390 POKE SCREEN+MX+20*MY,0:SC2=SC2+
     2:GOSUB 1460:IF TRS1=241 THEN P
     OKE SCREEN+XPL1+20*(MY+1),0:TRS
     1=0:PU1=PU1+1
1400 XPL1=1:YPL1=11:GOSUB 1090
1410 RETURN
1420 POKE SCREEN+MX+20*MY,0:MX=MX-1:
     IF MX=0 THEN RETURN

1430 GOTO 1330
1440 RETURN
1450 REM Score printer
1460 POSITION 6,1:? #6;SC1:POSITION
     12,1:? #6;SC2:RETURN
1470 REM To 'Replay' push "START"
1480 FOR I=0 TO 20:C=INT(256*RND(0))
1490 POKE 712,C:FOR DEL=1 TO 25:NEXT
      DEL:POKE 53760,C:POKE 53761,16
     8:NEXT I
1500 POKE 712,131:REM Restore to Set
     color 4,8,3
1510 POSITION 5,7:? #6;"GAME OVER"
1520 IF SC1>HSC THEN HSC=SC1
1530 IF SC2>HSC THEN HSC=SC2
1540 POSITION 2,12:? #6;"HIGH SCORE
     - ";HSC
1550 FOR DEL=1 TO 100:NEXT DEL:POKE
     53761,0
1560 IF PEEK(53279)<>6 THEN 1560
1570 GOTO 160
1580 REM INITIALIZATION
1590 REM Internal char set to ROM
1600 FOR I=0 TO 1023:POKE CHSET+I,PE
     EK(57344+I):SOUND 0,PEEK(CHSET+
     I),10,8:NEXT I
1610 REM Custom character formation
1620 FOR NUM=0 TO 5:READ LOC
1630 FOR I=0 TO 7:READ BN:SOUND 0,BN
     ,10,8
1640 POKE CHSET+(LOC*8)+I,BN
1650 NEXT I:NEXT NUM:SOUND 0,0,0,0
1660 DATA 55,24,24,24,24,60,126,255,
     255
1670 DATA 42,90,60,126,213,171,126,6
     0,90
1680 DATA 43,7,12,28,254,254,28,12,7
1690 DATA 44,24,0,24,0,0,24,0,24
1700 DATA 46,0,0,0,16,56,16,0,0
1710 DATA 49,0,0,0,36,60,0,0,0
1720 REM ** RL & UD Are for joystick
      routine
1730 UD(5)=1:UD(6)=-1:UD(7)=0:UD(9)=
     1:UD(10)=-1:UD(11)=0:UD(13)=1:U
     D(14)=-1:UD(15)=0
1740 RL(5)=1:RL(6)=1:RL(7)=1:RL(9)=-
     1:RL(10)=-1:RL(11)=-1:RL(13)=0:
     RL(14)=0:RL(15)=0
1750 RETURN
```

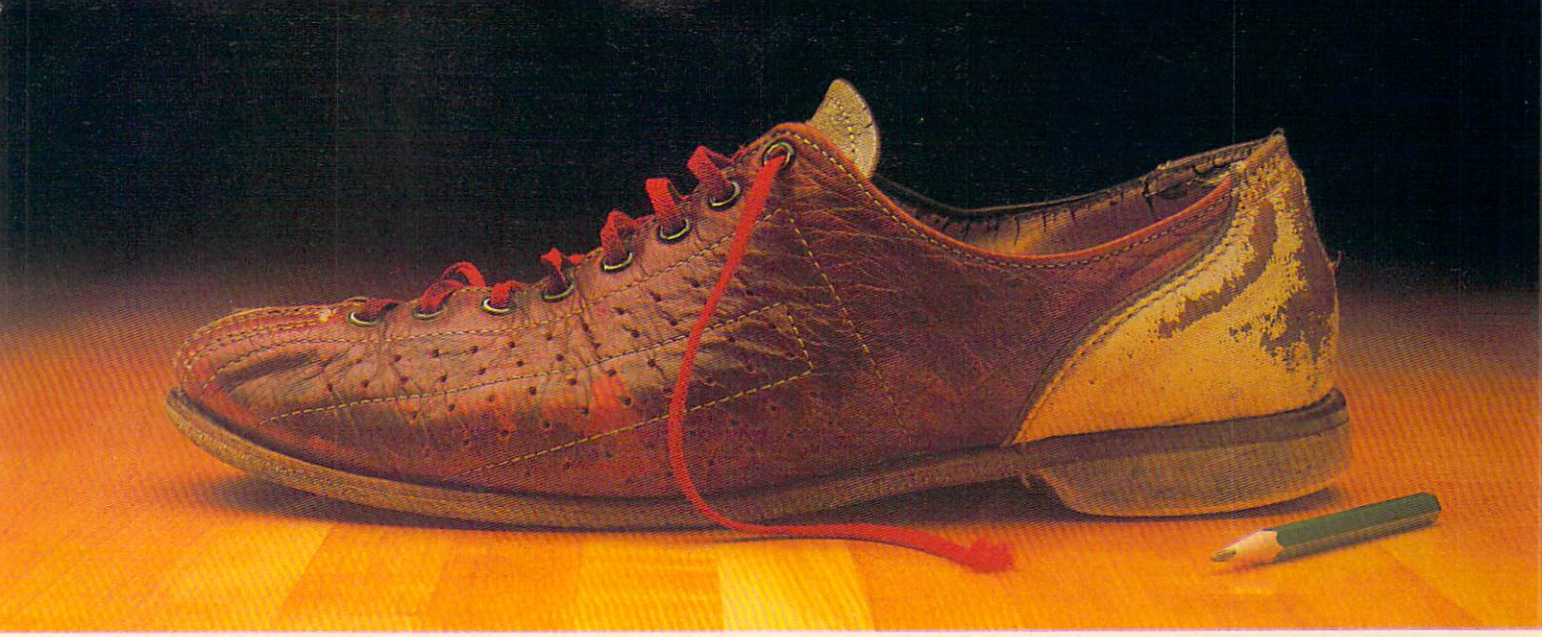


"Space Thief." 64 version.

Program 2: Space Thief — 64 Version

Translation by Gregg Peele, Assistant Programming Supervisor

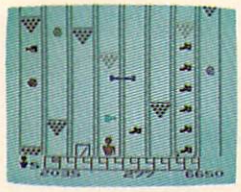
```
40 GOSUB60000:GOSUB15851:GOSUB49131:POKE5
   3248+16,(PEEK(53248+16)AND254)
45 GOSUB51179
50 RESTORE:SYS49152:PRINT"{CLR}";:POKE532
   81,0:POKE53280,0:POKE53272,28:GOSUB900
100 H=842:Y=845:C=843:P=850:POKE836,2
200 R=(RND(0)*20)+10:POKEH,R:U=(RND(0)*15
    )+4:POKEY,U:POKEP,160:SYS50530:
300 FORT=1TO60:POKE1304,PEEK(862)+48:POKE
    1304+54272,1:POKE1343+54272,1
310 POKE1343,PEEK(860)+48
320 IFPEEK(860)>=3ORPEEK(862)>=3THENT=60:
    NEXT:GOTO2000
350 NEXT:POKEP,32:SYS50530:GOTO200
900 FORT=1024 TO 1264STEP40:READY:POKET+5
    4272,1:POKET,Y:NEXT
910 FORT=1063 TO 1303STEP40:READY:POKET+5
    4272,1:POKET,Y:NEXT:RETURN
1000 DATA 144,140,129,153,133,146,178
1100 DATA 144,140,129,153,133,146,177
```



DON'T LAUGH. FIVE MINUTES OF ALLEY-OOPS AND YOU WON'T BE ABLE TO TAKE YOUR EYES OFF IT.

Oh sure—it might look silly now. But wait'll it's hurtling toward you, threatening to destroy your perfect game. You'll take it seriously then.

And bowling shoes won't be your only worry. You'll also have to watch for diabolical beer bottles, evil pin sweeps and vicious gum spots.



Sound strange?

Sure. But battling such weird objects is exactly what makes Alley-Oops so original. And so incredibly fun to play.

Alley-Oops is real arcade stuff. In fact, it's a challenge just to get to the next level of play. And there are 8 levels, the last one being the nearly impossible Challenge Round.

There are all kinds of ways to play Alley-Oops—try to mount up points, score a perfect game or reach that highest level. Whichever way you choose, you'll have endless fun playing Alley-Oops.

Just remember—don't take the bowling shoes lightly. After years of being kicked around bowling alleys, they're out to get even.

To survive Alley-Oops, you'll have to contend with diabolical beer bottles, evil pin sets, and vicious gum spots.

Alley-Oops™—A new arcade game from Artworx.® Designed by Jeffrey Godish and Brian Harkins; programmed by Leonard Bertoni and David Pompea. For the Commodore 64 and Atari (16K) computers. Cassette/diskette $29.95. Artworx Software Co., Inc., 150 North Main St., Fairport, N.Y. 14450. For a free catalog of Artworx software write or call 800-828-6573.

Artworx®

So you can play.

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```
2000 IF PEEK(860)>=3THENSYS50712:PRINT"
     {CLR}{WHT}{9 RIGHT}RIGHT PLAYER WINS
     ":GOTO2020
2010 SYS50712:PRINT"{CLR}{WHT}{9 RIGHT}LE
     FT PLAYER WINS"
2020 POKE53272,21:POKE53248+21,0:PRINT"
     {9 RIGHT}{2 DOWN}PLAY AGAIN Y OR N"
2030 H=PEEK(197):IFH<>25ANDH<>39THEN2030
2040 IFH=25THEN50
2050 SYS2048
15851 I=15872:C1=0:PRINT"{CLR}ENTERING SP
      RITE DATA"
15858 READ A:IF A=256 THEN 15867
15865 POKE I,A:C1=C1+A:I=I+1:GOTO 15858
15867 IF C1<>30458THENPRINT"{CLR}ERROR DA
      TA STATEMENTS (15872-16383)":END
15868 RETURN
15872 DATA 2,170,128,10,170,160,42
15879 DATA 170,168,63,255,252,42,0
15886 DATA 168,63,255,252,42,170,168
15893 DATA 10,170,160,2,170,128,0
15900 DATA 0,0,0,0,0,0,0
15907 DATA 0,0,0,0,0,0,0
15914 DATA 0,0,0,0,0,0,0
15921 DATA 0,0,0,0,0,0,0
15928 DATA 0,0,0,0,0,0,0
15935 DATA 0,2,170,128,10,170,160
15942 DATA 42,170,168,63,255,252,42
15949 DATA 0,168,63,255,252,42,170
15956 DATA 168,10,170,160,2,170,128
15963 DATA 0,0,0,0,0,0,0
15970 DATA 0,0,0,0,0,0,0
15977 DATA 0,0,0,0,0,0,0
15984 DATA 0,0,0,0,0,0,0
15991 DATA 0,0,0,0,0,0,0
15998 DATA 0,0,0,80,0,0,168
16005 DATA 0,1,84,0,1,182,0
16012 DATA 1,84,0,0,168,0,0
16019 DATA 80,0,0,0,0,0,0
16026 DATA 0,0,0,0,0,0,0
16033 DATA 0,0,0,0,0,0,0
16040 DATA 0,0,0,0,0,0,0
16047 DATA 0,0,0,0,0,0,0
16054 DATA 0,0,0,0,0,0,0
16061 DATA 0,0,0,0,80,0,0
16068 DATA 168,0,1,84,0,1,182
16075 DATA 0,1,84,0,0,168,0
16082 DATA 0,80,0,0,0,0,0
16089 DATA 0,0,0,0,0,0,0
16096 DATA 0,0,0,0,0,0,0
16103 DATA 0,0,0,0,0,0,0
16110 DATA 0,0,0,0,0,0,0
16117 DATA 0,0,0,0,0,0,0
16124 DATA 0,0,0,0,2,170,128
16131 DATA 10,170,160,42,170,168,63
16138 DATA 255,252,42,0,168,63,255
16145 DATA 252,42,170,168,10,170,160
16152 DATA 2,170,128,0,40,0,0
16159 DATA 40,0,0,170,0,10,170
16166 DATA 160,42,170,168,10,170,160
16173 DATA 0,170,0,0,0,0,0
16180 DATA 0,0,0,0,0,0,0
16187 DATA 0,0,0,0,0,2,170
16194 DATA 128,10,170,160,42,170,168
16201 DATA 63,255,252,42,0,168,63
16208 DATA 255,252,42,170,168,10,170
16215 DATA 160,2,170,128,0,40,0
16222 DATA 0,40,0,0,170,0,10
16229 DATA 170,160,42,170,168,10,170
16236 DATA 160,0,170,0,0,0,0
16243 DATA 0,0,0,0,0,0,0
16250 DATA 0,0,0,0,0,0,255
16257 DATA 255,255,255,255,255,63,0
16264 DATA 252,15,195,240,195,255,195
16271 DATA 240,255,15,252,60,63,63
16278 DATA 0,252,15,195,240,255,255
16285 DATA 255,255,255,255,0,0,0
16292 DATA 0,0,0,0,0,0,0
16299 DATA 0,0,0,0,0,0,0
16306 DATA 0,0,0,0,0,0,0
16313 DATA 0,0,0,0,0,0,0
16320 DATA 255,255,255,255,255,255,63
16327 DATA 0,252,15,195,240,195,255
16334 DATA 195,240,255,15,252,60,63
16341 DATA 63,0,252,15,195,240,255
16348 DATA 255,255,255,255,255,0,0
16355 DATA 0,0,0,0,0,0,0
16362 DATA 0,0,0,0,0,0,0
16369 DATA 0,0,0,0,0,0,0
16376 DATA 0,0,0,0,0,0,0
16383 DATA 0,0,256
49131 I=49152:C2=0:PRINT"{CLR}ENTERING MA
      CHINE LANGUAGE"
49138 READ A:IF A=256 THEN 49146
49145 POKE I,A:C2=C2+A:I=I+1:GOTO 49138
49146 IFC2<>205982 THENPRINT"{CLR}ERROR I
      N DATA STATEMENTS LINES (49152-5072
      0):END
49147 RETURN
49152 DATA 169,0,141,92,3,141,94
49159 DATA 3,169,48,13,21,208,141
49166 DATA 21,208,169,229,141,200,207
49173 DATA 141,204,207,169,34,141,198
49180 DATA 207,169,0,141,199,207,169
49187 DATA 55,141,202,207,169,1,141
49194 DATA 203,207,169,5,141,43,208
49201 DATA 169,7,141,44,208,169,254
49208 DATA 141,252,7,141,253,7,169
49215 DATA 12,13,21,208,141,21,208
49222 DATA 169,250,141,250,7,169,251
49229 DATA 141,251,7,169,2,141,41
49236 DATA 208,141,42,208,169,0,141
49243 DATA 216,207,169,15,141,28,208
49250 DATA 169,50,141,0,208,169,120
49257 DATA 141,1,208,169,15,141,2
49264 DATA 208,169,2,13,16,208,141
49271 DATA 16,208,169,50,141,224,207
49278 DATA 169,0,141,225,207,169,15
49285 DATA 141,226,207,169,1,141,227
49292 DATA 207,169,3,13,21,208,141
49299 DATA 21,208,169,248,141,248,7
49306 DATA 169,1,141,39,208,169,2
49313 DATA 169,249,141,249,7,169,120
49320 DATA 141,3,208,120,169,184,141
49327 DATA 20,3,169,192,141,21,3
49334 DATA 88,96,162,0,32,215,192
49341 DATA 162,1,32,215,192,32,134
49348 DATA 194,32,103,195,32,65,196
49355 DATA 32,152,195,32,203,197,32
49362 DATA 22,197,76,49,234,238,37
49369 DATA 208,189,0,220,41,15,157
49376 DATA 228,207,56,169,15,253,228
49383 DATA 207,157,232,207,238,38,208
49390 DATA 160,0,200,152,221,232,207
49397 DATA 208,249,224,1,208,2,162
49404 DATA 2,152,10,168,185,10,193
49411 DATA 72,185,9,193,72,96,132
49418 DATA 194,88,194,92,194,132,194
49425 DATA 100,194,104,194,111,194,132
49432 DATA 194,96,194,125,194,118,194
```

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Space Thief Notes For 64 Version

The 64 version of "Space Thief" uses an interrupt-driven ML routine which controls the position of all sprites and any collisions between them. BASIC is used to provide random numbers for the barrier's position and to keep score for both players. Points are accumulated in this version when you collect pods by touching your opponent's base and transporting the pods back to your own base. One point is awarded for each pod returned. The first player to attain three points wins.

Sound easy? There are hazards. If you are blasted by the opposing player or touch the barrier, you lose your cargo and are returned to your starting position. If you are touching your base, your opponent cannot collect or deposit a pod. Obviously, though, you will never get any points, either. The best plan is to use a combination of offensive and defensive strategies. Two joysticks are required.

```
49439 DATA 132,194,169,50,221,1,208
49446 DATA 176,12,189,1,208,56,189
49453 DATA 1,208,233,1,157,1,208
49460 DATA 96,169,229,221,1,208,144
49467 DATA 12,189,1,208,24,189,1
49474 DATA 208,105,1,157,1,208,96
49481 DATA 56,189,224,207,233,56,157
49488 DATA 228,207,189,225,207,233,1
49495 DATA 29,228,207,144,13,169,56
49502 DATA 157,224,207,169,1,157,225
49509 DATA 207,76,122,193,24,189,224
49516 DATA 207,105,1,157,224,207,189
49523 DATA 225,207,105,0,157,225,207
49530 DATA 56,189,224,207,233,0,157
49537 DATA 228,207,189,225,207,233,1
49544 DATA 29,228,207,144,19,224,2
49551 DATA 240,34,173,16,208,9,1
49558 DATA 141,16,208,189,224,207,157
49565 DATA 0,208,96,224,2,240,30
49572 DATA 173,16,208,41,254,141,16
49579 DATA 208,189,224,207,157,0,208
49586 DATA 96,173,16,208,9,2,141
49593 DATA 16,208,189,224,207,157,0
49600 DATA 208,96,173,16,208,41,253
49607 DATA 141,16,208,189,224,207,157
49614 DATA 0,208,96,56,189,224,207
49621 DATA 233,34,157,228,207,189,225
49628 DATA 207,233,0,29,228,207,176
49635 DATA 13,169,33,157,224,207,169
49642 DATA 0,157,225,207,76,2,194
49649 DATA 56,189,224,207,233,1,157
49656 DATA 224,207,189,225,207,233,0
49663 DATA 157,225,207,56,189,224,207
49670 DATA 233,0,157,228,207,189,225
49677 DATA 207,233,1,29,228,207,144
49684 DATA 19,224,2,240,34,173,16
49691 DATA 208,9,1,141,16,208,189
49698 DATA 224,207,157,0,208,96,224
49705 DATA 2,240,30,173,16,208,41
49712 DATA 254,141,16,208,189,224,207
49719 DATA 157,0,208,96,173,16,208
49726 DATA 9,2,141,16,208,189,224
49733 DATA 207,157,0,208,96,173,16
49740 DATA 208,41,253,141,16,208,189
49747 DATA 224,207,157,0,208,96,32
49754 DATA 33,193,96,32,53,193,96
49761 DATA 32,73,193,96,32,209,193
49768 DATA 96,32,33,193,32,209,193
49775 DATA 96,32,53,193,32,209,193
49782 DATA 96,32,53,193,32,73,193
49789 DATA 96,32,33,193,32,73,193
49796 DATA 96,96,56,173,190,207,233
49803 DATA 0,141,160,207,173,191,207
49810 DATA 233,1,13,160,207,176,17
49817 DATA 173,16,208,41,251,141,16
49824 DATA 208,173,190,207,141,4,208
49831 DATA 76,184,194,173,190,207,141
49838 DATA 4,208,169,4,13,16,208
49845 DATA 141,16,208,173,192,207,141
49852 DATA 5,208,56,173,194,207,233
49859 DATA 0,141,162,207,173,195,207
49866 DATA 233,1,13,162,207,176,17
49873 DATA 173,16,208,41,247,141,16
49880 DATA 208,173,194,207,141,6,208
49887 DATA 76,240,194,173,194,207,141
49894 DATA 6,208,169,8,13,16,208
49901 DATA 141,16,208,173,196,207,141
49908 DATA 7,208,56,173,198,207,233
49915 DATA 0,141,164,207,173,199,207
49922 DATA 233,1,13,164,207,176,17
49929 DATA 173,16,208,41,239,141,16
49936 DATA 208,173,198,207,141,8,208
49943 DATA 76,40,195,173,198,207,141
49950 DATA 8,208,169,16,13,16,208
49957 DATA 141,16,208,173,200,207,141
49964 DATA 9,208,56,173,202,207,233
49971 DATA 0,141,166,207,173,203,207
49978 DATA 233,1,13,166,207,176,17
49985 DATA 173,16,208,41,223,141,16
49992 DATA 208,173,202,207,141,10,208
49999 DATA 76,96,195,173,202,207,141
50006 DATA 10,208,169,32,13,16,208
50013 DATA 141,16,208,173,204,207,141
50020 DATA 11,208,96,173,0,220,41
50027 DATA 16,208,17,173,216,207,208
50034 DATA 12,173,68,3,41,4,208
50041 DATA 5,169,1,141,216,207,173
50048 DATA 1,220,41,16,208,17,173
50055 DATA 218,207,208,12,173,68,3
50062 DATA 41,8,208,5,169,1,141
50069 DATA 218,207,96,173,216,207,208
50076 DATA 47,24,173,224,207,105,20
50083 DATA 141,190,207,173,225,207,105
50090 DATA 0,141,191,207,173,1,208
50097 DATA 141,192,207,173,68,3,41
50104 DATA 1,240,6,32,234,196,32
50111 DATA 35,197,173,21,208,41,251
50118 DATA 141,21,208,76,59,196,173
50125 DATA 21,208,9,4,141,21,208
50132 DATA 56,173,190,207,233,65,141
50139 DATA 62,3,173,191,207,233,1
50146 DATA 13,62,3,176,70,173,68
50153 DATA 3,41,1,240,9,32,234
50160 DATA 196,32,35,197,76,45,196
50167 DATA 173,64,3,41,6,201,6
```

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```
50174 DATA 208,9,32,234,196,32,68
50181 DATA 197,76,45,196,173,68,3
50188 DATA 41,4,240,6,32,234,196
50195 DATA 76,45,196,24,173,190,207
50202 DATA 105,4,141,190,207,173,191
50209 DATA 207,105,0,141,191,207,169
50216 DATA 1,141,216,207,96,169,0
50223 DATA 141,216,207,173,21,208,41
50230 DATA 251,141,21,208,96,169,0
50237 DATA 141,216,207,96,173,218,207
50244 DATA 208,47,56,173,226,207,233
50251 DATA 20,141,194,207,173,227,207
50258 DATA 233,0,141,195,207,173,3
50265 DATA 208,141,196,207,173,68,3
50272 DATA 41,2,240,6,32,234,196
50279 DATA 32,68,197,173,21,208,41
50286 DATA 247,141,21,208,76,228,196
50293 DATA 173,21,208,9,8,141,21
50300 DATA 208,56,173,194,207,233,30
50307 DATA 141,66,3,173,195,207,233
50314 DATA 0,13,66,3,144,70,173
50321 DATA 68,3,41,2,240,9,32
50328 DATA 234,196,32,68,197,76,214
50335 DATA 196,173,64,3,41,9,201
50342 DATA 9,208,9,32,234,196,32
50349 DATA 35,197,76,214,196,173,68
50356 DATA 3,41,8,240,6,32,234
50363 DATA 196,76,214,196,56,173,194
50370 DATA 207,233,4,141,194,207,173
50377 DATA 195,207,233,0,141,195,207
50384 DATA 169,1,141,218,207,96,169
50391 DATA 0,141,218,207,173,21,208
50398 DATA 41,247,141,21,208,96,169
50405 DATA 0,141,218,207,96,160,24
50412 DATA 169,0,153,0,212,136,208
```


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```
50419 DATA 250,169,15,141,24,212,169
50426 DATA 17,141,5,212,169,248,141
50433 DATA 6,212,169,100,141,0,212
50440 DATA 141,1,212,169,129,141,4
50447 DATA 212,169,128,141,4,212,96
50454 DATA 173,30,208,141,64,3,173
50461 DATA 31,208,141,68,3,96,169
50468 DATA 50,141,224,207,169,0,141
50475 DATA 225,207,173,224,207,141,0
50482 DATA 208,173,225,207,173,16,208
50489 DATA 41,254,141,16,208,169,248
50496 DATA 141,248,7,96,169,30,141
50503 DATA 226,207,169,1,141,227,207
50510 DATA 173,226,207,141,2,208,169
50517 DATA 2,13,16,208,141,16,208
50524 DATA 169,249,141,249,7,96,169
50531 DATA 0,133,251,169,4,133,252
50538 DATA 162,0,142,78,3,173,82
50545 DATA 3,141,75,3,232,172,74
50552 DATA 3,173,75,3,145,251,138
50559 DATA 205,77,3,144,21,169,32
50566 DATA 141,75,3,238,78,3,173
50573 DATA 78,3,201,6,144,6,173
50580 DATA 82,3,141,75,3,24,169
50587 DATA 212,101,252,133,252,172,74
50594 DATA 3,169,7,145,251,56,165
50601 DATA 252,233,212,133,252,24,165
50608 DATA 251,105,40,133,251,165,252
50615 DATA 105,0,133,252,56,165,251
50622 DATA 233,232,133,2,165,252,233
50629 DATA 7,5,2,208,171,96,173
50636 DATA 64,3,41,51,201,18,208
50643 DATA 5,169,253,141,249,7,173
50650 DATA 64,3,41,51,201,34,208
50657 DATA 15,173,249,7,201,253,208
50664 DATA 8,169,249,141,249,7,238
50671 DATA 92,3,173,64,3,41,51
50678 DATA 201,33,208,5,169,252,141
50685 DATA 248,7,173,64,3,41,51
50692 DATA 201,17,208,15,173,248,7
50699 DATA 201,252,208,8,169,248,141
50706 DATA 248,7,238,94,3,96,120
50713 DATA 169,49,141,20,3,169,234
50720 DATA 141,21,3,88,96,256
51179 I=51200:C3=0:PRINT"{CLR}MOVING CHAR
      ACTERS"
51186 READ A:IF A=256 THEN 51194
51193 POKE I,A:C3=C3+A:I=I+1:GOTO 51186
51194 IF C3<>8822THEN PRINT"ERROR IN DATA
       STATEMENTS LINES(51200-51256)":END
51195 SYS51200:RETURN
51200 DATA 120,173,14,220,41,254,141
51207 DATA 14,220,165,1,41,251,133
51214 DATA 1,169,208,133,252,169,48
51221 DATA 133,254,169,0,133,251,133
51228 DATA 253,168,162,8,177,251,145
51235 DATA 253,200,208,249,230,252,230
51242 DATA 254,202,208,242,165,1,9
51249 DATA 4,133,1,173,14,220,9
51256 DATA 1,141,14,220,88,96,256
60000 FORT=1TO14:READ Z:NEXT:RETURN
```

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CHOPPEROIDS

L. L. Beh

You're a chopperoid pilot on a life-and-death mission: Navigate through the deadly asteroid field to reach a disintegrating satellite with nine scientists on board. You must transport them one at a time back through the asteroid field to the safety of the heliport. Written for the Atari, a joystick or trackball is required. This game is entirely in machine language for speed and smooth motion.

When I saw what an improvement a small machine language routine made in my BASIC "Closeout" game (COMPUTE!, March 1983), I set out to learn machine language in earnest. I read all the books on machine language programming I could get my hands on, then bought an Atari Assembler Editor cartridge. "Chopperoids" is my first game written completely in machine language.

Rescue The Scientists

The problems involved in cleaning up chemical waste dumps have caused such a public outcry that all future chemical research has been banished to space. One chemical company has placed its research facilities on a satellite in geosynchronous orbit just beyond a dense asteroid field. The rationale was that the asteroids would provide a natural security system to prevent other companies from pilfering top-secret company formulas. However, an experiment on the satellite has gotten out of control and gallons of a potent solvent have leaked out. This chemical is so strong that it's causing the satellite itself to dissolve. Nine scientists are trapped on board, and you must take to your chopperoid and brave the asteroid field to save them.

Playing The Game

You will be creating a boot tape or boot disk for this game. To begin, remove BASIC or any other cartridges from your Atari. For cassette, put the tape in the recorder, then turn on the computer while holding down the START key. When the Atari beeps, press play on the recorder. For disk, power up the disk drive, insert the boot disk, then turn on the computer. When the game is loaded, you will see a title screen for a few seconds while the game initializes.

Press the SELECT key to choose one of three levels of play. The higher the level, the more asteroids you must dodge. Press the START key to energize the first of your three chopperoids. It will appear in blue on the heliport at the bottom center of the screen, while your remaining chopperoids stand by in the lower-left corner. Maneuver the chopperoid with a joystick plugged into port 1. You have full control in any direction. If you have a trackball, you may find it to be a better controller for this game than a joystick.

Your goal is to navigate through the asteroid field to the landing pad of the satellite at the top left of the screen. Collision with an asteroid will force you to make a crash landing and switch to a new chopperoid. When you have landed, one of the stranded scientists will run out and board your chopperoid, which then turns red. You must deliver your passenger safely through the asteroid field to the heliport at the bottom of the screen. When you land at the heliport, the rescued scientist will alight from your chopperoid and run into the base station, leaving your chopperoid ready for another mission. You get 50 points for each scientist rescued and a 250-point bonus for rescuing all nine.

Fortunately for you as the chopperoid pilot, your craft is not defenseless. Use the fire button to blast any asteroids that come too close to your chopperoid. You will be awarded extra points for each disintegrated asteroid based on its size and speed. But you can't spend too much time blasting

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asteroids because all the while the research satellite is melting away. You have only a matter of minutes before it's all gone.

When all nine scientists have been rescued, the game begins again with a new satellite. There's no rest for the weary chopperoid pilot. If you fail to rescue all nine scientists before the satellite completely melts away, or if you crash all three chopperoids before rescuing all the scientists, the game ends. If you've managed to beat the high score, your total will replace the current high value.

The game can be restarted at any time by pressing the START key. The SYSTEM RESET key will only take you back to the title screen, so you must turn off the computer when you are finished playing.

Program Development

In writing Chopperoids, I am deeply indebted to John Palevich for his program "Shoot," which appeared in COMPUTE! (September 1981). This program provided significant insight into creating self-booting machine language games.

Chopperoids makes use of Atari's Display List Interrupts (DLIs) and Vertical Blank Interrupts (VBIs). The DLI is used to move and change the color of the asteroids, and to check for collisions. In level 3 there can be up to 27 asteroids on the screen at once in all different colors. The VBI is used to update the score, check the remaining time, create the game sounds, and change the speed and shape of the asteroids flying across the screen. During the main loop of the program, the joystick is read, the helicoper is moved, and the satellite is "melted."

Typing In The Program

Since Chopperoids is written entirely in machine language, it cannot be typed in directly like a program in BASIC. You must use the MLX: Machine Language Editor found elsewhere in this issue. Be sure to read and understand the MLX article before attempting to enter Chopperoids.

When you run MLX, it will ask you several questions. Here are the proper answers for Chopperoids:

starting address:	**3584**
ending address:	**6122**
run/init address:	**3606**

You should then select the option to create a boot disk or boot tape. Follow the instructions provided by the MLX program and enter the Chopperoids data. MLX will prevent any typing errors.

Chopperoids

```
3584:000,021,226,013,022,014,040
3590:169,226,141,231,002,133,140
3596:014,169,013,141,232,002,071
3602:133,015,169,022,133,010,244
```

"Chopperoids" is a fast-action machine language game for the Atari.

```
3608:169,014,133,011,024,096,215
3614:000,020,000,014,008,014,086
3620:024,096,169,060,141,002,016
3626:211,169,022,133,010,169,244
3632:014,133,011,096,076,193,059
3638:018,112,112,112,070,000,222
3644:024,006,006,240,112,240,176
3650:112,240,112,240,112,240,098
3656:112,240,112,240,112,240,104
3662:112,240,112,240,112,006,132
3668:065,025,014,032,091,067,122
3674:093,032,049,057,056,051,172
3680:032,067,079,077,080,085,004
3686:084,069,032,032,032,067,162
3692:072,079,080,080,069,242,218
3698:239,233,228,032,076,069,223
3704:086,069,076,032,036,037,200
3710:038,032,032,032,037,037,078
3716:037,041,041,041,039,037,112
3722:040,032,032,032,033,033,084
3728:033,032,032,032,083,084,184
3734:065,082,084,047,083,069,068
3740:076,069,067,084,041,041,022
3746:041,041,035,035,077,069,204
3752:078,032,076,069,070,084,065
3758:032,032,032,032,072,073,191
3764:071,072,032,032,083,067,025
3770:079,082,069,032,136,024,096
3776:058,088,154,248,184,074,230
3782:218,104,230,170,232,042,170
3788:070,024,138,200,090,184,142
3794:182,216,072,106,166,234,162
3800:040,120,218,248,000,000,074
3806:000,000,000,000,000,000,222
3812:000,000,000,000,000,000,228
3818:000,000,000,000,000,000,234
3824:000,000,000,000,000,000,240
3830:000,000,000,000,000,000,246
3836:000,000,000,000,000,000,252
3842:000,000,000,000,000,000,002
3848:000,000,000,000,000,000,008
3854:000,000,000,000,000,000,014
3860:000,000,000,000,000,000,020
3866:000,000,000,000,000,000,026
3872:000,000,000,000,000,000,032
```

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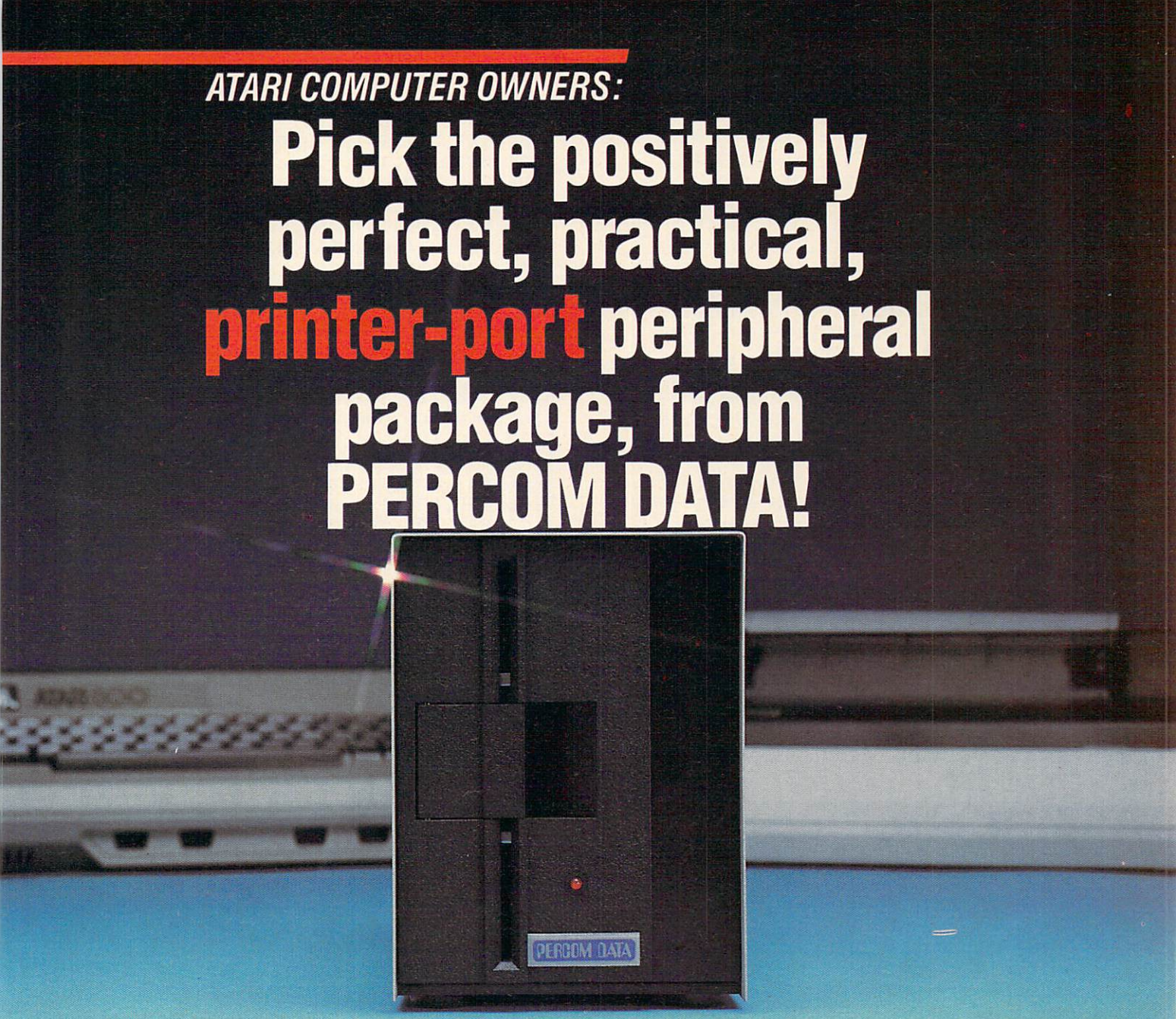

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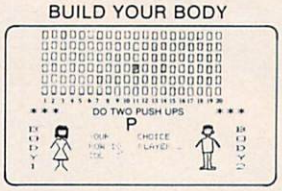

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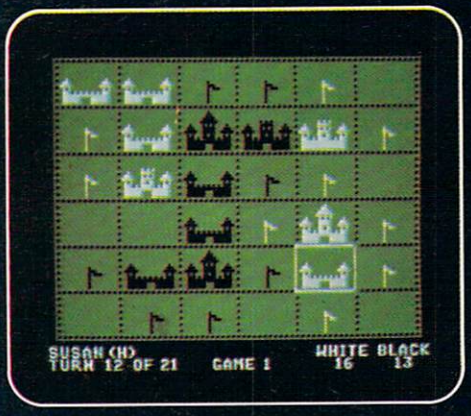
Like such classics as chess and *go*, FORTRESS ($34.95) is beautifully simple: Occupy a place, fortify it, lay siege to your opponent's fortresses, and dominate the countryside. The rules are few; the possible moves, nearly limitless. FORTRESS is very fast — each game lasts less than ten minutes.

This two-player game also contains a great solitaire scenario. Five different computer opponents are provided, each endowed with a unique style of play. For example, there is the ruthlessly aggressive Genghis Khan and Lord Maginot, the master of defense.

The crowning glory is that the computer opponents not only play, they *learn and improve* as they play you. The better you get, the better they get! Which brings forth a most fascinating event:



ANNOUNCING THE $1,000 SSI FORTRESS TOURNAMENT

Since you teach the computer opponents every time you play them, they are really an extension of yourself. SSI proudly announces a very different kind of strategy game tournament: computer versus computer! Send us the disk of your best trained computer player and we'll match it against other entries. The winner (the human, not his disk!) of this battle of electronic wits will win $1,000! Complete details in each FORTRESS box.

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FORTRESS, a game destined to be a classic, awaits you.

On disk for the Apple® II with Applesoft ROM Card. Apple II Plus, IIe, and III.

Also on disk for the 40K Atari® 400/800/1200 with BASIC Cartridge.

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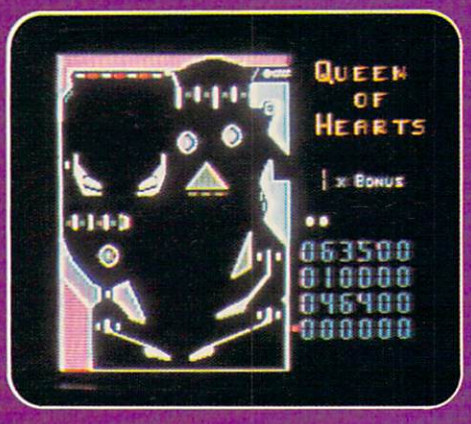
- Sound effects to complete the illusion of a real pinball game.

So if you're itching for a pinball game, don't think pinball arcade. Think computer/software or game store instead, 'cause that's where you can get hold of QUEEN OF HEARTS.



See above for Apple® specifications. On disk for the 48K Atari® 400/800/1200 with 2 joysticks.

If there are no convenient stores near you, VISA & Mastercard holders can order direct by calling **800-227-1617, ext. 335 (toll free).** In California, call 800-772-3545, ext. 335. To order by mail, send your check to: Strategic Simulations Inc, 883 Stierlin Road, Bldg. A-200, Mountain View, CA 94043. (California residents, add 6.5% sales tax.) Please specify computer format.

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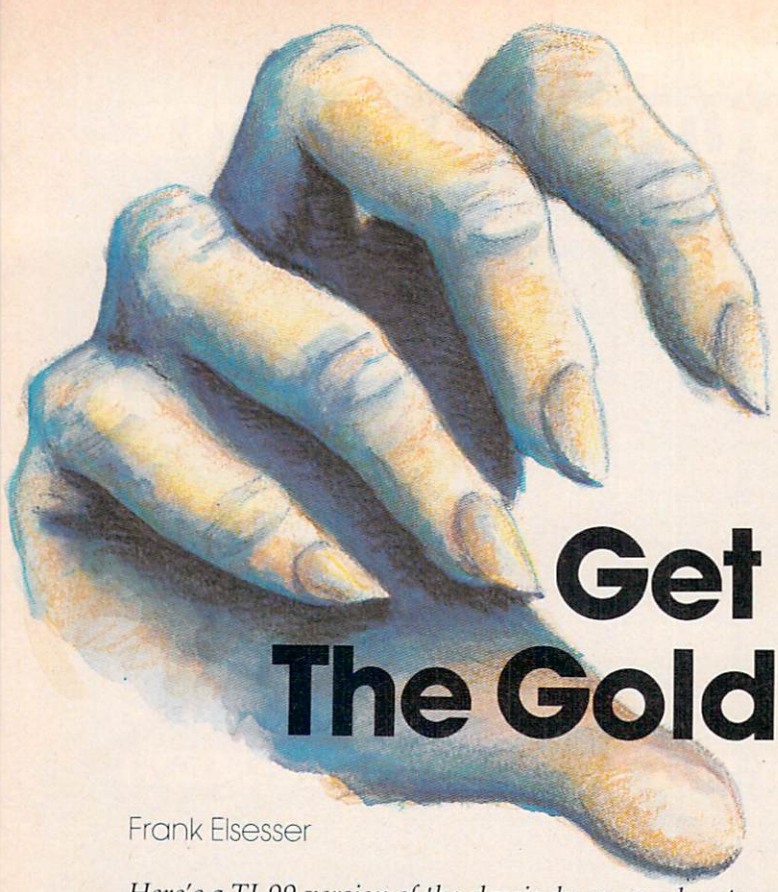

Get The Gold

Frank Elsesser

Here's a TI-99 version of the classic dungeon adventure game, complete with perfidious monsters, cunning thieves, and dangerous trap doors. The game also includes some pretty eerie sound effects.

If you're brave enough, this game will take you into a two-level, 128-chamber dungeon on a quest for treasure. You may come out rich, or you may not come out at all. Finding your way through the passages might seem simple enough if you were alone in the dungeon, but there are monsters hiding in some of the chambers. In others, thieves will attempt to steal part of your hard-won gold. Some chambers have trap doors in the floor which drop you back to a lower level or send you plummeting into deep pits.

Since the game is quite long, it is divided into two segments. The first part (Program 1) gives detailed instructions on playing, and the second part (Program 2) is the game itself. You should first type in Program 1 and, after checking for errors, SAVE it to tape. Don't rewind the tape. Next, type in Program 2. After correcting any typing errors, SAVE Program 2 immediately after Program 1 on the same tape. When you load and run Program 1, it will give you instructions on loading the second part.

If you do not want to type in the programs, send a blank cassette, a self-addressed stamped mailer, and $3 to:

Frank Elsesser
1307 Douglas Drive
Sterling, IL 61801

Program 1: Game Instructions

```
100 CALL SCREEN(2)
110 CALL CLEAR
120 FOR C=1 TO 8
130 CALL COLOR(C,16,2)
140 NEXT C
150 PRINT "{7 SPACES}GET THE GOLD":
    :::::
160 PRINT "INSTRUCTIONS.....
    ....":::::::
170 FOR J=1 TO 11
180 READ A,B,C
190 CALL SOUND(A,B,0,C,0)
200 NEXT J
210 DATA 125,262,131,125,294,131,25
    0,156,131,250,131,147,250,262,1
    31,100,262,131
220 DATA 100,294,123,100,311,131,10
    0,392,131,100,294,131,100,311,1
    31,200,131,262
230 CALL SOUND(200,131,0,262,3,523,
    3)
240 FOR DELAY=1 TO 500
250 NEXT DELAY
260 CALL CLEAR
270 PRINT "GET THE GOLD IS AN ADVEN
    TURE"::"GAME, WHERE THE PLAYER
    MUST"::"ANSWER CERTAIN QUESTION
    S AS"::
280 PRINT "HE WANDERS THROUGH THE":
    :"CHAMBERS AND TUNNELS OF A"::"
    TWO-LEVEL MAZE.":::::::
290 PRINT "PRESS ANY KEY TO CONTINU
    E...":::
300 CALL KEY(0,K,S)
310 IF S=0 THEN 300
320 CALL CLEAR
330 PRINT "THE PROGRAM"
340 PRINT "--- -------"
350 PRINT
360 PRINT "YOU ARE GIVEN 1,000 GOLD
    ":"PIECES, AND THEN TRANSPORTED
    ":"TO THE LOWER LEVEL OF A 128-
    ":
370 PRINT "CHAMBER, TWO-LEVEL DUNGE
    ON":"(64 CHAMBERS PER LEVEL).":
380 PRINT "YOUR GOAL IS TO ESCAPE W
    ITH":"AS MUCH GOLD AS POSSIBLE.
    ":"GOLD PIECES ARE ACQUIRED BY":
390 PRINT "ANSWERING THE QUESTION A
    SKED":"BY THE MONSTERS THAT INH
    ABIT":"THE DUNGEON.":::
400 PRINT "EACH TIME AN ANSWER IS":
    "CORRECT, GOLD IS GIVEN AS A":"
    REWARD.  IF THE ANSWER IS":
410 PRINT "INCORRECT, THEN GOLD IS"
    :"TAKEN AWAY.":::
420 PRINT "PRESS ANY KEY TO CONTINU
    E..."
430 CALL KEY(0,K,S)
440 IF S=0 THEN 430
```

Janice Fary

```
450 CALL CLEAR
460 PRINT "THE QUESTION"
470 PRINT "--- --------"
480 PRINT
490 PRINT "THE MONSTERS WILL ASK YO
    U"::"ONE SPECIAL QUESTION AS YO
    U"::"TRAVEL THROUGH THE DUNGEON
    ":::
500 PRINT "WHERE IS THE GOLD?":::"H
    INT: WHERE WOULD YOU PUT"::"1,Ø
    ØØ GOLD PIECES IF YOU"::
510 PRINT "WERE CARRYING THEM?"::::
    "PRESS ANY KEY TO CONTINUE..."
520 CALL KEY(Ø,K,S)
530 IF S=Ø THEN 520
540 CALL CLEAR
550 PRINT "MOVES"
560 PRINT "-----"
570 PRINT
580 PRINT "AS YOU MOVE THROUGH THE"
    :"DUNGEON YOU WILL ENCOUNTER":"
    MONSTERS, THIEVES, EMPTY":
590 PRINT "CHAMBERS, TRAP DOORS, SE
    CRET":"DOORS LEADING INTO NORTH
    -":"SOUTH AND EAST-WEST TUNNELS
    ,":
600 PRINT "AND SUPER KEYS.":"TO MO
    VE, ENTER THE LETTER":"IN PAREN
    THESES FOR THE":"DESIRED MOVE O
    R ACTION:"::
610 PRINT "1- (N)ORTH{3 SPACES}2- (
    E)AST":"3- (S)OUTH{3 SPACES}4-
    (W)EST":"5- (Q)UIT [ENDS GAME]"
    :
620 PRINT "6- (G)OLD [GIVES GOLD CO
    UNT]":"7- (U)P  [USED AT STAIRW
    AYS]"::
630 PRINT "PRESS ANY KEY TO CONTINU
    E..."
640 PRINT
650 CALL KEY(Ø,K,S)
660 IF S=Ø THEN 650
670 CALL CLEAR
680 PRINT "GAME RATING"
690 PRINT "---- ------"
700 PRINT
710 PRINT "AFTER YOU COMPLETE THE G
    AME,":"A GAME RATING IS DISPLAY
    ED,":"ALONG WITH THE NUMBER OF"
    :
720 PRINT "GOLD PIECES ACQUIRED AND
    ":"NUMBER OF TURNS IT TOOK YOU"
    :"TO FIND YOUR WAY OUT.":::
730 PRINT "THE RATING WILL BE SOMEW
    HERE":"BETWEEN -5ØØ AND +1ØØØ.
     THE":"HIGHER THE NUMBER, THE":
740 PRINT "BETTER THE RATING.  A":"
    NEGATIVE NUMBER INDICATES A":"P
    OOR RATING.":::"GOOD LUCK!!!!!
    ":::
750 PRINT "PRESS ENTER.............
    ..."
760 CALL KEY(Ø,K,S)
770 IF S=Ø THEN 760
780 CALL CLEAR
790 PRINT "TO PLAY:":"{4 SPACES}TY
    PE NEW, THEN OLD CS1":::::::::
800 FOR DELAY=1 TO 1ØØØ
810 NEXT DELAY
```

Program 2: Get The Gold

```
100 CALL CLEAR
110 FOR CC=1 TO 8
120 CALL COLOR(CC,5,11)
130 NEXT CC
140 CALL SCREEN(11)
160 FOR DDD=1 TO 500
170 NEXT DDD
180 CALL CLEAR
190 PRINT "GET THE GOLD!":::::::::
200 PRINT "AN ENCHANTED ADVENTURE"::
210 FOR J=1 TO 2
220 IA=200
230 CALL SOUND(IA,131,0,262,3,523,3)
240 CALL SOUND(IA,147,0,294,3,587,3)
250 CALL SOUND(IA,131,0,311,3,622,3)
260 CALL SOUND(IA,156,0,311,3,622,3)
270 CALL SOUND(IA,131,0,294,3,587,3)
280 CALL SOUND(IA,156,0,294,3,587,3)
290 CALL SOUND(IA*2,131,0,262,3,523,3)
300 CALL SOUND(IA,156,0,262,3)
310 CALL SOUND(IA,123,0,294,3)
320 CALL SOUND(IA,131,0,311,3)
330 CALL SOUND(IA,156,0,392,3)
340 CALL SOUND(IA,131,0,294,3)
350 CALL SOUND(IA,156,0,311,3)
360 CALL SOUND(IA*2,131,0,262,3)
370 NEXT J
380 CALL CLEAR
390 CALL SCREEN(14)
400 FOR CC=1 TO 8
410 CALL COLOR(CC,16,14)
420 NEXT CC
430 DIM P(9,9,2)
440 PRINT "YOU WILL BE TAKEN TO"::
450 PRINT "THE DUNGEON"::
460 FOR DELAY=1 TO 500
470 NEXT DELAY
480 CALL CLEAR
490 RANDOMIZE
500 MA=0
510 CA=0
520 G=1000
530 M1=1
540 K=0
550 PRINT "WHO ART THOU?"::
560 INPUT A$
610 CALL CLEAR
620 GOSUB 860
630 CALL SCREEN(7)
640 FOR CC=1 TO 8
650 CALL COLOR(CC,16,7)
660 NEXT CC
670 PRINT "YOU CARRY 1000 GOLD PIECES
      WITH YOU"::
680 GOSUB 860
690 PRINT A$;". . . OFF YOU GO . . .
    .":::
700 GOSUB 860
710 GOSUB 900
720 CALL CLEAR
730 CALL SCREEN(2)
740 FOR CC=1 TO 8
750 CALL COLOR(CC,16,2)
760 NEXT CC
770 PRINT "YOU HAVE ARRIVED AT . . .
    . ":::
780 PRINT "THE DUNGEON . . BOTTOM LEV
    EL"::
790 PRINT "YOU WILL COME ACROSS
    {8 SPACES}MONSTERS":::
800 PRINT "THIEVES, AND GOLD. . . BUT
      WATCH"::
810 PRINT "YOUR STEP . . . . . .
    . ":::
```

```
820 PRINT "TRAP DOORS CAN BE COSTLY.
    . "
830 FOR AB=1 TO 2000
840 NEXT AB
850 GOTO 1840
860 REM
870 FOR Z2=1 TO 400
880 NEXT Z2
890 RETURN
900 REM
910 FOR X=1 TO 8
920 FOR Y=1 TO 8
930 FOR Z=1 TO 2
940 P(X,Y,Z)=INT(RND*7)+1
950 NEXT Z
960 NEXT Y
970 NEXT X
980 REM
990 H=INT(RND*3)+1
1000 FOR A=1 TO 2
1010 FOR N=1 TO H
1020 X=INT(RND*8)+1
1030 Y=INT(RND*8)+1
1040 P(X,Y,A)=8
1050 NEXT N
1060 NEXT A
1070 S=INT(RND*4)+2
1080 FOR A=1 TO 2
1090 FOR N=1 TO S
1100 X=INT(RND*8)+1
1110 Y=INT(RND*8)+1
1120 P(X,Y,A)=9
1130 NEXT N
1140 NEXT A
1150 RETURN
1160 REM
1170 L1=L1-1
1180 PRINT "YOU WALK UP THE STAIRWAY.
     ...":::
1190 N=1
1200 X=INT(RND*5)
1210 IF X=2 THEN 1270
1220 CALL SOUND(5,-3,5)
1230 CALL SOUND(30,-7,20)
1240 CALL SOUND(500,-7,30)
1250 N=N+1
1260 IF N=15 THEN 1290 ELSE 1200
1270 CALL SOUND(60,-7,20)
1280 GOTO 1240
1290 REM
1300 GOSUB 860
1310 CALL SCREEN(11)
1320 FOR CC=1 TO 8
1330 CALL COLOR(CC,5,11)
1340 NEXT CC
1350 PRINT "YOU PUT THE SUPER KEY INT
     O  THE LOCK . . . . . ."
     ::
1360 GOSUB 860
1370 PRINT "THE DOOR IS OPEN"::
1380 CALL SOUND(125,131,0)
1390 CALL SOUND(125,147,0)
1400 CALL SOUND(500,165,0)
1410 CALL SOUND(250,165,0)
1420 CALL SOUND(250,165,0)
1430 CALL SOUND(250,147,0)
1440 CALL SOUND(250,165,0)
1450 CALL SOUND(750,175,0)
1460 CALL SOUND(500,165,0)
1470 FOR A=0 TO 30 STEP 5
1480 CALL SOUND(-99,698,A,1924,A)
1490 NEXT A
1500 FOR A=0 TO 30 STEP 5
1510 CALL SOUND(-99,554,A,1527,A)
1520 NEXT A
1530 GOSUB 860
1540 IF L1=0 THEN 1620
1550 MA=0
1560 K=0
1570 K4=INT(RND*4)+4
1580 CB=CA+K4
1590 PRINT "YOU ARE AT . . . THE UPPE
     R  LEVEL"::
1600 GOSUB 860
1610 GOTO 1900
1620 PRINT "YOU FOUND YOUR WAY . . .
     . ."::
1630 PRINT "OUT OF THE DUNGEON"::
1640 CALL SOUND(1000,262,2,330,2,392,
     2)
1650 CALL SOUND(1000,349,2,392,2,440,
     2)
1660 PRINT "YOU HAVE ACQUIRED ";G;" G
     OLD PIECES."::
1670 FOR J=1 TO 11
1680 READ MMM,NNN,OOO
1690 CALL SOUND(MMM,NNN,0,OOO,0)
1700 NEXT J
1710 DATA 125,262,131,125,294,131,250
     ,156,131,250,131,147,250,262,131
     ,100,262,131
1720 DATA 100,294,123,100,311,131,100
     ,392,131,100,294,131,100,311,131
     ,125,262,131,200,131,262
1730 CALL SOUND(200,131,0,262,3,523,3
     )
1740 GOSUB 1760
1750 GOTO 2690
1760 GG=G+100
1770 R=INT((GG*CA-7000+1)/M1)
1780 PRINT
1790 PRINT "YOUR RATING IS ";R
1800 PRINT
1810 IF G<=0 THEN 5380
1820 PRINT "IT TOOK YOU ";M1;"
     {10 SPACES}TURNS TO FIND THE WAY
     OUT"::
1830 RETURN
1840 REM
1850 C=INT(RND*8)+1
1860 D=INT(RND*8)+1
1870 P(C,D,2)=1
1880 L1=2
1890 K4=INT(RND*4)+4
1900 CALL CLEAR
1910 A=P(C,D,L1)
1920 GOSUB 860
1930 ON A GOSUB 2960,3010,3060,3060,3
     140,3730,3800,3860,4170
1940 PRINT
1950 IF G<=0 THEN 2570
1960 PRINT A$;"  WHAT IS YOUR ACTION?
     "
1970 PRINT
1980 PRINT "(N)ORTH, (S)OUTH, (E)AST,
     {3 SPACES}(W)EST, (U)P, (G)OLD,
     OR{4 SPACES}(Q)UIT"::
1990 CALL KEY(0,K,S)
2000 IF S=0 THEN 1990
2010 CALL CLEAR
2020 M1=M1+1
2030 IF M1>=140/L1 THEN 5270
2040 IF K=78 THEN 2150
2050 IF K=69 THEN 2200
2060 IF K=83 THEN 2250
2070 IF K=87 THEN 2300
2080 IF K=85 THEN 2350
2090 IF K=71 THEN 2410
```

```
2100 IF K=81 THEN 2120
2110 GOTO 1960
2120 END
2130 PRINT
2140 GOTO 1940
2150 REM
2160 IF A=7 THEN 2450
2170 IF (D-1)=0 THEN 2780
2180 D=D-1
2190 GOTO 1900
2200 REM
2210 IF A=6 THEN 2510
2220 IF (C+1)=9 THEN 2840
2230 C=C+1
2240 GOTO 1900
2250 REM
2260 IF A=7 THEN 2450
2270 IF (D+1)=9 THEN 2880
2280 D=D+1
2290 GOTO 1900
2300 REM
2310 IF A=6 THEN 2510
2320 IF (C-1)=0 THEN 2920
2330 C=C-1
2340 GOTO 1900
2350 CALL CLEAR
2360 IF A<>9 THEN 2380
2370 IF K>-1 THEN 1160
2380 PRINT "YOU ARE NOT AT A STAIRWAY
     . ":::
2390 GOSUB 860
2400 REM
2410 REM
2420 CALL CLEAR
2430 PRINT "YOU HAVE ";G;" GOLD PIECE
     S.":::
2440 GOTO 1940
2450 REM
2460 PRINT
2470 CALL CLEAR
2480 PRINT "YOU ARE IN AN EAST-WEST
     {5 SPACES}TUNNEL":::
2490 PRINT "YOU CAN ONLY GO EAST OR W
     EST":::
2500 GOTO 1940
2510 REM
2520 PRINT
2530 CALL CLEAR
2540 PRINT "YOU ARE IN A NORTH-SOUTH
     {4 SPACES}TUNNEL":::
2550 PRINT "YOU CAN ONLY GO NORTH OR
     {4 SPACES}SOUTH":::
2560 GOTO 2500
2570 REM
2580 GOSUB 860
2590 PRINT
2600 CALL SOUND(250,139,2)
2610 CALL SOUND(10,2000,2)
2620 CALL SOUND(250,139,2)
2630 CALL SOUND(10,2000,2)
2640 CALL SOUND(500,185,2)
2650 PRINT "YOU LOST ALL YOUR GOLD AN
     D  YOU WERE":::
2660 PRINT " . . . UNABLE TO  ESCAPE
     {4 SPACES}THE DUNGEON IN TIME.":
     :::
2670 PRINT "MAYBE NEXT TIME":::
2680 GOSUB 1760
2690 PRINT
2700 PRINT "ANOTHER GAME?":::
2710 PRINT "ENTER '1'-YES  'O'-NO":::
2720 INPUT AA
2730 CALL CLEAR
2740 IF AA<>1 THEN 2770
2750 CALL CLEAR
2760 GOTO 450
2770 END
2780 CALL CLEAR
2790 PRINT "YOU ARE AT THE NORTH WALL
     ":::
2800 CALL SOUND(-500,400,2,-4,2)
2810 PRINT "YOU CANNOT PASS THROUGH":
     :
2820 PRINT "TRY ANOTHER DIRECTION.":::
2830 GOTO 1940
2840 CALL CLEAR
2850 PRINT "YOU ARE AT THE EAST WALL"
     :::
2860 CALL SOUND(-500,400,2,-4,2)
2870 GOTO 2810
2880 CALL CLEAR
2890 PRINT "YOU ARE AT THE SOUTH WALL
     ":::
2900 CALL SOUND(-500,400,2,-4,2)
2910 GOTO 2810
2920 CALL CLEAR
2930 PRINT "YOU ARE AT THE WEST WALL"
     :::
2940 CALL SOUND(-500,400,2,-4,2)
2950 GOTO 2810
2960 REM
2970 PRINT
2980 PRINT "YOU ARE IN A . . . . . .
     . .":::
2990 PRINT " . . . . EMPTY CHAMBER":::
3000 RETURN
3010 REM
3020 PRINT
3030 PRINT "YOU ARE IN A SMOKEY . . .
      .":::
3040 PRINT " . . . . . . . EMPTY CHAM
     BER":::
3050 RETURN
3060 CALL CLEAR
3070 GOSUB 5220
3080 RANDOMIZE
3090 M4=INT(RND*10)+1
3100 GOSUB 4290
3110 ON M4 GOSUB 4410,4520,4720,4810,
     4410,4720,4520,4520,4410,4810
3120 PRINT
3130 RETURN
3140 CALL CLEAR
3150 PRINT "THERE'S A THIEF IN THIS R
     OOM":::
3160 FOR I=1 TO 5
3170 CALL SOUND(500,110,2)
3180 CALL SOUND(-500,330,1)
3190 NEXT I
3200 P(C,D,L1)=2
3210 GOSUB 860
3220 G4=INT(350/L1*RND)+1
3230 RANDOMIZE
3240 Y=INT(RND*8)+1
3250 IF Y<=5 THEN 3600
3260 PRINT
3270 PRINT " . . . . . HE SURPRISES Y
     OU.":::
3280 GOSUB 860
3290 PRINT "AS HE QUICKLY RUNS BY HE"
     :::
3300 PRINT "STEALS . . . ";G4;" GOLD
     {4 SPACES}PIECES":::
3310 G=G-G4
3320 REM
3330 GOSUB 860
3340 PRINT "YOU SEARCH THE ROOM AND F
     IND ":::
```

```
3350 RANDOMIZE
3360 ZZZ=INT(RND*14)+1
3370 ON ZZZ GOSUB 3390,3490,3410,3430
     ,3450,3470,3490,3490,3510,3390,3
     530,3550,3570,3490
3380 GOTO 3590
3390 PRINT "A DEAD MAN"::
3400 RETURN
3410 PRINT "A MOLDY COFFIN"
3420 RETURN
3430 PRINT "A ROACH"
3440 RETURN
3450 PRINT "A SLAIN MONSTER"
3460 RETURN
3470 PRINT "A PIECE OF BREAD"
3480 RETURN
3490 PRINT "A TREASURE CHEST"::
3491 GOSUB 860
3492 PRINT "YOU OPEN THE LID.....
     ..":::
3493 GOSUB 860
3494 RANDOMIZE
3495 G54=INT(RND*2000)+1
3496 PRINT "AND FIND";G54;" GOLD PIEC
     ES."
3497 G=G+G54
3498 PRINT
3500 RETURN
3510 PRINT "A TI HOME COMPUTER"
3520 RETURN
3530 PRINT "AN OLD SWORD"
3540 RETURN
3550 PRINT "A CANDLE"
3560 RETURN
3570 PRINT "THE WIZARDS REWARD-1,000
     {4 SPACES}GOLD PIECES"
3580 G=G+1000
3590 RETURN
3600 PRINT "YOU SURPRISED THE THIEF .
      .":::
3610 GOSUB 860
3620 PRINT "AS HE RUNS OUT HE DROPS .
      . ":::
3630 PRINT " . . . . ";G4;" GOLD PIEC
     ES"::
3640 PRINT "YOU PICK UP THE GOLD PIEC
     ES"::
3650 G=G+G4
3660 IF M1=1 THEN 3670 ELSE 3680
3670 RETURN
3680 MA=INT(RND*4)+1
3690 IF M1<=2 THEN 3700 ELSE 3710
3700 MA=1
3710 IF MA=1 THEN 3340
3720 RETURN
3730 CALL CLEAR
3740 PRINT
3750 GOSUB 5440
3760 REM
3770 PRINT " . . . ENTER A NORTH-SOUT
     H  TUNNEL"::
3780 GOSUB 5400
3790 RETURN
3800 CALL CLEAR
3810 PRINT
3820 GOSUB 5440
3830 PRINT " . . . ENTER AN EAST-WEST
     {3 SPACES}TUNNEL"::
3840 GOSUB 5400
3850 RETURN
3860 REM
3870 CALL SOUND(250,139,2)
3880 CALL SOUND(10,2000,2)
3890 CALL SOUND(250,139,2)
3900 CALL SOUND(10,2000,2)
3910 CALL SOUND(500,185,2)
3920 PRINT "YOU STEPPED ON A . . . .
     . . TRAP DOOR"::
3930 GOSUB 860
3940 TD=INT(RND*4)+1
3950 IF TD>=3 THEN 3990
3960 PRINT
3970 PRINT "BUT .  . YOU CAUGHT YOURS
     ELF"::
3980 RETURN
3990 IF L1=2 THEN 4100
4000 L1=L1+1
4010 K=1
4020 PRINT "YOU FELL THRU TO . . . .
     . .THE BOTTOM LEVEL . . . . AND"
     ::
4030 G=100
4040 GOSUB 860
4050 PRINT
4060 PRINT "YOU LOST MOST OF YOUR GOL
     D  PIECES"::
4070 PRINT "YOU HAVE . . . ";G;" GOLD
     {3 SPACES}PIECES LEFT"::
4080 PRINT "BUT, YOU STILL HAVE YOUR
     KEY"::
4090 RETURN
4100 PRINT "YOU FELL INTO A DEEP . .
     PIT"::
4110 GOSUB 860
4120 PRINT "YOU'RE LUCKY . . . . . .
     . ."::
4130 PRINT "YOU DID'NT GET HURT"::
4140 GOSUB 860
4150 PRINT "BUT IN CLIMBING OUT . . .
      . ":::
4160 GOTO 5310
4170 PRINT "YOU ARE AT A STAIRWAY"::
4180 PRINT " . . . . . GOING UP . . .
      .":::
4190 N=1
4200 FOR F=700 TO 900 STEP 5
4210 CALL SOUND(-99,F,0)
4220 NEXT F
4230 FOR F=900 TO 700 STEP -8
4240 CALL SOUND(-99,F,0)
4250 NEXT F
4260 N=N+1
4270 IF N=2 THEN 4280 ELSE 4200
4280 RETURN
4290 CALL SOUND(250,147,0,294,0)
4300 CALL SOUND(175,147,0,294,0)
4310 CALL SOUND(75,147,0,294,0)
4320 CALL SOUND(250,147,0,294,1)
4330 CALL SOUND(175,175,0,349,0)
4340 CALL SOUND(75,165,0,330,0)
4350 CALL SOUND(175,165,0,330,0)
4360 CALL SOUND(75,147,0,294,1)
4370 CALL SOUND(175,147,0,294,0)
4380 CALL SOUND(75,131,0,262,0)
4390 CALL SOUND(500,147,0,294,0,587,0
     )
4400 RETURN
4410 PRINT "HALT *** I AM DRA"::
4420 GOSUB 4860
4430 GOSUB 4900
4440 INPUT P$
4450 IF P$="BAG" THEN 4500
4460 IF P$="IN BAG" THEN 4500
4470 REM
4480 GOSUB 5080
4490 RETURN
4500 GOSUB 4930
4510 RETURN
```

```
4520 PRINT "STOP *** I AM BUS"::
4530 GOSUB 4860
4540 GOSUB 4900
4550 INPUT P$
4560 IF A$="IN BAG" THEN 4600
4570 IF P$="BAG" THEN 4600
4580 GOSUB 5080
4590 RETURN
4600 GOSUB 4930
4610 RETURN
4620 GOSUB 900
4630 H=1
4640 O=9
4650 W=8
4660 B=0
4670 E=5
4680 R=14
4690 C=0
4700 PR=0
4710 GOTO 1840
4720 PRINT "HALT *** I AM LUM!!!"::
4730 GOSUB 4860
4740 GOSUB 4900
4750 INPUT P$
4760 IF P$="BAG" THEN 4790
4770 GOSUB 5080
4780 RETURN
4790 GOSUB 4930
4800 RETURN
4810 PRINT "BEWARE  OF TRAP DOORS"::
4820 CALL SOUND(500,220,0,330,0,440,0)
4830 CALL SOUND(250,330,0,440,0,550,0)
4840 REM
4850 RETURN
4860 PRINT
4870 PRINT "*** YOU MAY NOT PASS
     {8 SPACES}THROUGH UNTIL"::
4880 PRINT "*** YOU TELL ME WHERE THE
     {3 SPACES}GOLD IS"::
4890 RETURN
4900 REM
4910 RETURN
4920 CALL CLEAR
4930 PRINT "GOOD,YOU MUST BE REWARDED
     .."
4940 PRINT
4950 G4=INT(400/L1*RND)+25
4960 K=1
4970 G=G+G4
4980 GOSUB 860
4990 PRINT "YOU WIN ";G4;" GOLD PIECE
     S"::
5000 GOSUB 5180
5010 P(C,D,L1)=1
5020 CA=CA+1
5030 IF K=1 THEN 5040 ELSE 5050
5040 RETURN
5050 IF CA=K4 THEN 5170
5060 IF L1=1 THEN 5290
5070 RETURN
5080 PRINT
5090 PRINT "YOU LIE"::
5100 PRINT "NO REWARD FOR YOU"::
5110 PRINT
5120 G4=INT(350/L1*RND)+1
5130 G=G-G4
5140 GOSUB 860
5150 PRINT "I WIN ";G4;" GOLD PIECES"
     ::
5160 RETURN
5170 GOSUB 860
5180 K=1
5190 PRINT "YOU HAVE FOUND THE SUPER
     KEY"::
5200 GOSUB 860
5210 RETURN
5220 PRINT "YOU DISTURBED A MONSTER I
     N{8 SPACES}HIS CHAMBER"::
5230 GOSUB 860
5240 PRINT "AND HE SPEAKS . . . . . .
     . "::
5250 GOSUB 860
5260 RETURN
5270 GOSUB 5180
5280 GOTO 2040
5290 IF CA=CB THEN 5170
5300 RETURN
5310 G=100
5320 GOSUB 860
5330 PRINT
5340 PRINT "YOU . . . . . DROPPED"::
5350 PRINT "MOST OF YOUR GOLD PIECES.
     "::
5360 PRINT "YOU HAVE . . ";G;" GOLD
     {5 SPACES}PIECES LEFT."::
5370 RETURN
5380 REM
5390 RETURN
5400 PRINT "THE DOOR CLOSES AND LOCKS
     {3 SPACES}BEHIND YOU"::
5410 CALL SOUND(1000,8207,30,8803,30,
     500,30,-8,5)
5420 GOSUB 860
5430 RETURN
5440 PRINT "YOU OPEN A SECRET DOOR AN
     D "::
5450 CALL SOUND(1000,8207,30,8803,30,
     500,30,-8,5)
5460 GOSUB 860
5470 RETURN
```

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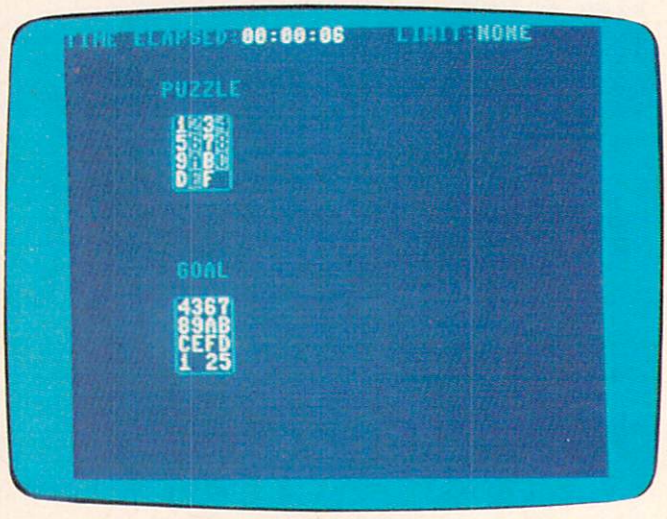
64 Mosaic Puzzle

Bruce Jordan

Translation by Chris Metcalf, Programming Assistant

In our October issue, we published a game, "Mosaic Puzzle," with versions for several computers. Program 2, which was identified as the 64 version, actually runs on the VIC. Here is the 64 version.



"Mosaic Puzzle" is a computer version of those sliding-squares puzzles that used to drive people nuts before the advent of Rubik's Cube. The object of the game is to arrange the 15 squares (1 – 8 and A – F) into some predetermined order by sliding them around in their frame. The first few moves are easy, but as the game progresses, it gets a lot more complicated. You'll find yourself rearranging everything just to get the last few squares in place.

When you start the game, you're asked if you wish to set a time limit. If you answer Y for yes, enter the time limit in one line with no spaces or punctuation between the values. For example, for a 1-hour, 23-minute limit, enter 012300. If no time limit is selected, the screen will display elapsed time and TIME LIMIT: NONE.

Next, enter the goal order that you will try to match to win the game. Note that some goals cannot be reached from the given starting arrangement. If you reach a point where only two adjacent tiles must be switched to complete the puzzle, then your goal is unreachable. You can also select various keys for up, down, left, and right movement. If you prefer a joystick, use port two. When you are playing, pressing the RETURN key or the fire button allows you to pause momentarily before resuming the game, restarting the program, or stopping entirely. Breaking off and resuming has no effect on the time clock (displayed at the top of the screen along with the time limit).

64 Mosaic Puzzle

```
100 POKE53280,14:POKE53281,6:POKE55,176:P
    OKE56,29:CLR:POKE54276,8:POKE54283,8
110 POKE54277,0:POKE54278,255:POKE54284,0
    :POKE54285,255:POKE54296,15
120 S=1355:SC=S+54272:DIMA$(16)
130 PRINT"{CLR}":G=1632:X=0:DX=1:P=55904:
    S1=54276:S2=54283:AD=1232:R=14
140 PRINT"{CLR}{DOWN}"TAB(11)"HEX NUMBER
    {SPACE}PUZZLE"TAB(51)"{17 Y}{DOWN}"
150 :
160 :
170 REM FIND TIME LIMIT, MOVE KEYS
180 PRINT"{7}  DO YOU WANT A TIME LIMIT?
     ";:GOSUB270
190 IFIN$<>"Y"THEN240
200 H=1:INPUT"{HOME}{6 DOWN} HOURS MINS S
    ECS (6 DIGITS)";T$:IFLEN(T$)<>6THEN20
    0
210 IFLEFT$(T$,2)>"23"ORLEFT$(T$,2)<"0"TH
    EN200
220 IFMID$(T$,3,2)>"59"ORMID$(T$,3,2)<"0"
    THEN200
```

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```
230 IFRIGHT$(T$,2)>"59"ORRIGHT$(T$,2)<"0"
    THEN200
240 PRINT"{DOWN} KEY FOR UP: ";:GOSUB270:
    U$=IN$:PRINT"{DOWN} FOR DOWN: ";:GOSU
    B270:D$=IN$
250 PRINT"{DOWN} FOR LEFT: ";:GOSUB270:L$
    =IN$:PRINT"{DOWN} FOR RIGHT: ";:GOSUB
    270:R$=IN$
260 GOTO310
270 PRINT"[+3]";:WAIT198,255:GETIN$:PRIN
    T"{LEFT}";:POKE216,1:PRINTIN$:RETURN
280 :
290 :
300 REM FIND GOAL ORDER
310 PRINT"{CLR}"TAB(43)"ENTER GOAL SETUP"
320 PRINT"{DOWN}{3 SPACES}1 2 3 4 5 6 7 8
     9"SPC(23)"A B C D E F {RVS}SPACE"
330 PRINTTAB(5)"{DOWN}IN ANY ORDER":PRINT
    TAB(248)"GOAL
340 FORK=0TO3:POKE1592+K,100:POKE1792+K,9
    9:POKE55864+K,R:POKE56064+K,R
350 POKE1631+K*40,103:POKE1636+K*40,101:P
    OKE55903+K*40,R:POKE55908+K*40,R:NEXT
360 FORI=1TO16:POKEG+X,63:POKEP+X,1
370 WAIT198,255:GETA$(I):FORL=I-1TO0STEP-
    1:IFA$(I)=A$(L)THEN370
380 NEXT:IFA$(I)=" "THENFORK=0TO4:POKE554
    71+K,15:NEXT:B2=32:GOTO420
390 IF(A$(I)<"1"ORA$(I)>"F")OR(A$(I)>"9"A
    NDA$(I)<"A")THEN370
400 B=VAL(A$(I)):B2=B+48:IFBTHENPOKE55417
    +2*B,15:GOTO420
410 B=ASC(A$(I))-64:B2=B:POKE55457+2*B,15
420 POKEG+X,B2:X=X+DX:IFX=4THENG=G+40:P=P
    +40:X=0
430 NEXT
440 :
450 :
460 REM SET UP WORK AREA
470 PRINT"{HOME}":FORI=0TO64:PRINT"
    {4 SPACES}";:NEXT:PRINT"{HOME}"TAB(12
    7)"PUZZLE"
480 FORK=0TO3:POKE1192+K,100:POKE55464+K,
    R:POKE1392+K,99:POKE55664+K,R
490 POKE1231+K*40,103:POKE55503+K*40,R:PO
    KE1236+K*40,101:POKE55508+K*40,R:NEXT
500 READA,B,C:IFA>=0THENPOKEAD+A,B:POKE55
    504+A,C:GOTO500
510 FORI=1TO500:NEXT:POKES1-3,80:POKES1,3
    3:PRINT"{HOME}"TAB(28)"{10 DOWN}{RED}
    {WHT}!GO![7]"
520 FORT=1TO300:NEXT:PRINT"{HOME}"TAB(28)
    "{10 DOWN}{4 SPACES}":POKES1,8:TI$="0
    00000"
530 PRINT"{HOME}"TAB(25)"LIMIT:{CYN}";:IF
    T$=""THENPRINT"NONE":GOTO580
540 PRINTLEFT$(T$,2)":"MID$(T$,3,2)":"RIG
    HT$(T$,2)"[7]"
550 :
560 :
570 REM LOOP MAIN CONTROL
580 PRINT"{HOME}TIME ELAPSED:{WHT}"LEFT$(
    TI$,2)":"MID$(TI$,3,2)":"RIGHT$(TI$,2
    )"[7]"
590 IFH=1ANDT$<=TI$THEN750
600 GETB$:J=31-PEEK(56320)AND31:IFB$=""AN
    DJ=0THEN580
610 IFB$=CHR$(13)ORJ=16THENWN=0:GOTO780
620 IFB$=D$OR(JAND2)THENDR=-40:CK=100:GOT
    O660
630 IFB$=L$OR(JAND4)THENDR=1:CK=101:GOTO6
    60
640 IFB$=R$OR(JAND8)THENDR=-1:CK=103:GOTO
    660
650 DR=40:CK=99:IFB$<>U$AND(JAND1)=0THEN5
    80
660 IFPEEK(S+DR)=CKTHEN580
670 POKES,PEEK(S+DR):POKESC,PEEK(SC+DR):P
    OKES+DR,32:S=S+DR:SC=SC+DR
680 FORM=0TO120STEP40:FORN=0TO3:W=PEEK(AD
    +M+N)AND127:IFW<>PEEK(1632+M+N)THEN58
    0
690 NEXT:NEXT:PRINT"{HOME}"TAB(24)"
    {5 DOWN}{CYN}{RVS}YOU WIN![7]":POKE
    S1-3,0:POKES1,33:WN=1
700 READN1,N2,D:IFN1=-1THENPOKES1,8:GOTO7
    80
710 POKES1-4,N1:POKES1-3,N2:FORT=1TOD:NEX
    T:GOTO700
720 :
730 :
740 REM END OF GAME
750 PRINT"{HOME}"TAB(23)"{5 DOWN}{WHT}
    {RVS}!YOU LOSE![7]":POKES1-3,10:POK
    ES1,17:WN=1
760 POKES2-3,60:POKES2,129:FORT=1TO300:NE
    XT:POKES2,8:POKES1,8
770 :
780 TM$=TI$:PRINT"{HOME}"TAB(21)"{9 DOWN}
    (1) RESET
790 PRINTTAB(21)"{DOWN}(2) QUIT":IFWN=0TH
    ENPRINTTAB(21)"{DOWN}(3) AS YOU LEFT
    {SPACE}IT"
800 GETV$:IFV$<"1"ORV$>"3"THEN800
810 IFV$="1"THENRUN
820 IFV$="2"THENEND
830 IFWNTHEN800
840 PRINT"{HOME}{8 DOWN}":FORI=1TO6:PRINT
    TAB(21)"{18 SPACES}":NEXT
850 TI$=TM$:GOTO580
860 :
870 :
880 REM SETUP AND MUSIC DATA
890 DATA0,49,1,1,178,3,2,51,1,3,180,3
900 DATA40,53,1,41,182,3,42,55,1,43
910 DATA184,3,80,57,1,81,129,3,82,2,1
920 DATA83,131,3,120,4,1,121,133,3,122
930 DATA6,1,123,32,3,-1,-1,-1
940 DATA 96,22,150,0,0,50,96,22,75,0,0,50
    ,96,22,75,49,28,175,96,22,115,49,28
950 DATA175,135,33,250,0,0,0,-1,-1,-1   ©
```


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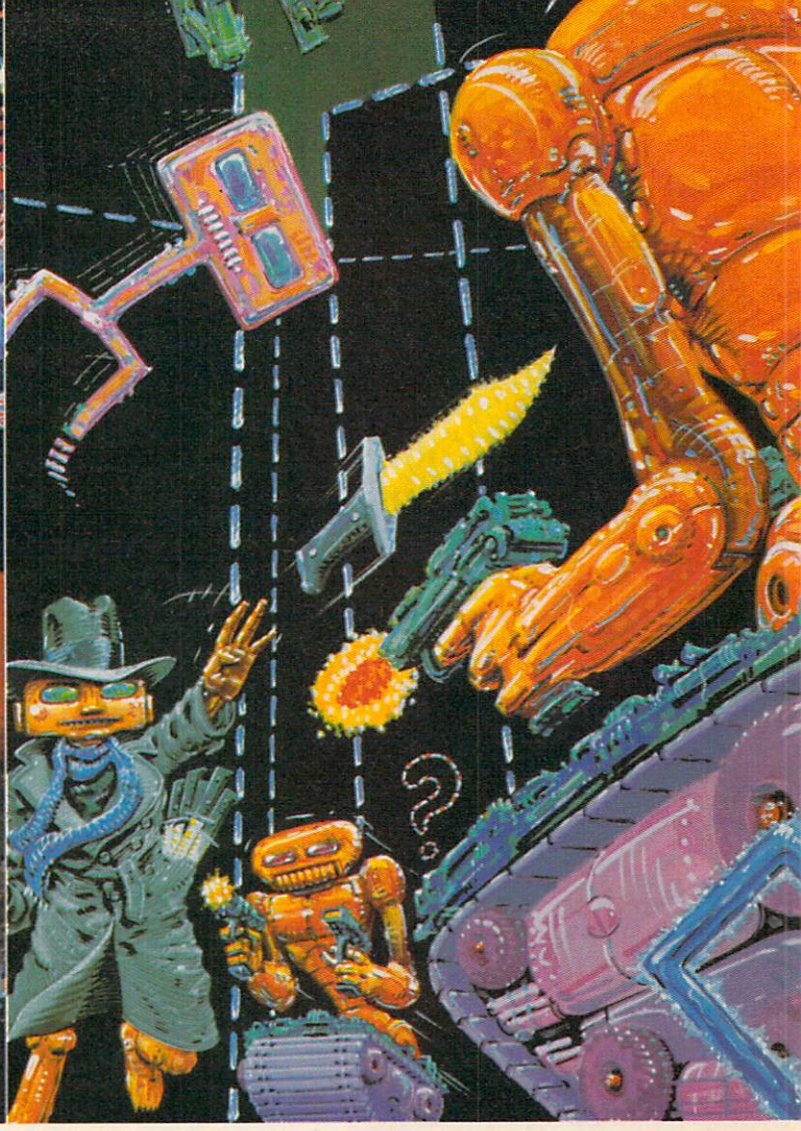

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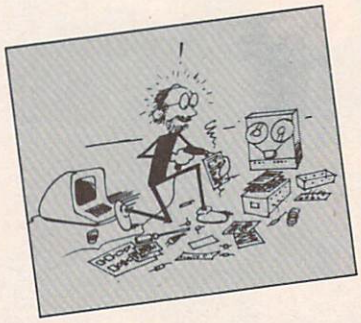
Winnie The Pooh's Alphabet Adventures

Fred D'Ignazio, Associate Editor



One afternoon while Eric was riding his Big Wheel bike on the sidewalk in front of his house, a brown UPS truck pulled up, and a man hopped out and put some giant boxes on Eric's front porch. Eric went and got his dad. His dad told him that inside the boxes was a new NEC Trek home computer that had been sent, on loan, from the NEC Home Electronics Company in Elk Grove Village, Illinois.

They set the computer up in Eric's bedroom. He liked the computer. It was neat to look at, with its ivory case, and its gray and orange keys. It was easy to use, too. He used its Micro Painter program to make pictures and its Electric Pencil program to do lots of gobbledygook processing.

The NEC Trek was special, too, because it had games with all of Eric's favorite Walt Disney characters. He wanted to play the games and see Mickey Mouse, Donald Duck, Cinderella, the 101 Dalmations, and Winnie the Pooh. But, so far, he still hadn't played any of the games.

His dad had lots of excuses to explain why the games weren't ready. He mumbled something about RAMs and ROMs and an extended BASIC cartridge that hadn't arrived.

Eric already had a game disk with the word WINNIE written in big letters in blue ink. The disk had a game called Winnie the Pooh's Alphabet Adventures. But his dad told him that they still didn't have a disk drive to put the disk into.

He really wanted to see the Winnie the Pooh program, so he put pressure on his dad to get his act together and find the equipment they needed to make the program work.

Pretty soon, more big brown boxes started arriving in the mail. Eric loved opening boxes. He had never run into a box he couldn't open. When he was only six months old, his parents put a box around him, with holes for his head, legs, and arms. On the side of the box his dad drew, in big letters, the words PAPER SHREDDER. And he drew lots of pretend dials and switches. It was Eric's first Halloween costume. He went to three

The first frame of Winnie the Pooh's Alphabet Adventures game is on the display screen. Next to the NEC Trek computer are several other games produced by the Walt Disney Educational Media Company.

Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. His books include Katie and the Computer *(Creative Computing),* Chip Mitchell: The Case of the Stolen Computer Brains *(Dutton/Lodestar),* The Star Wars Question and Answer Book About Computers *(Random House), and* How To Get Intimate With Your Computer (A 10-Step Plan To Conquer Computer Anxiety) *(McGraw-Hill).*

As the father of two young children, Fred has become concerned with introducing the computer to children as a wonderful tool rather than as a forbidding electronic device. His column appears monthly in COMPUTE!.

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Halloween parties, crawled around on the floor, and shredded any paper that he found in his path.

But Eric wasn't a baby any longer. He was four years old, and he could shred boxes the way he used to shred paper. When the computer boxes arrived, he opened all of them with his bare hands. Inside the boxes were the computer parts his dad had told him about. He helped his dad attach all the parts to the main computer that was sitting on a little table in Eric's bedroom.

Run, Winnie, Run!

Finally a box came with the last part. Eric huffed and puffed and "Hulked" open the box. Then he and his dad raced to his bedroom to put the missing part into the computer.

His dad turned on the power. The computer worked! Eric hopped around the room. He almost fell on the computer, he was so excited.

His dad let him put the Winnie the Pooh disk into the disk drive. He let Eric do everything on the computer all by himself. While he was working on the computer, sometimes he saw his dad put his hands over his eyes. Sometimes he saw him grit his teeth and look like he was going to cry. Sometimes he even heard him growl. But he always let Eric do everything. Because of this, Eric was getting pretty good at computers, even though he was only four years old.

His dad read from the NEC manual for the *Alphabet Soup* package. Eventually there would be two programs in the package: the Winnie the Pooh alphabet game and another game called Mickey's Lucky Stars. Mickey's Lucky Stars would teach Eric how to match small letters in the alphabet with big letters; and help him learn which letters come before other letters and which ones come after.

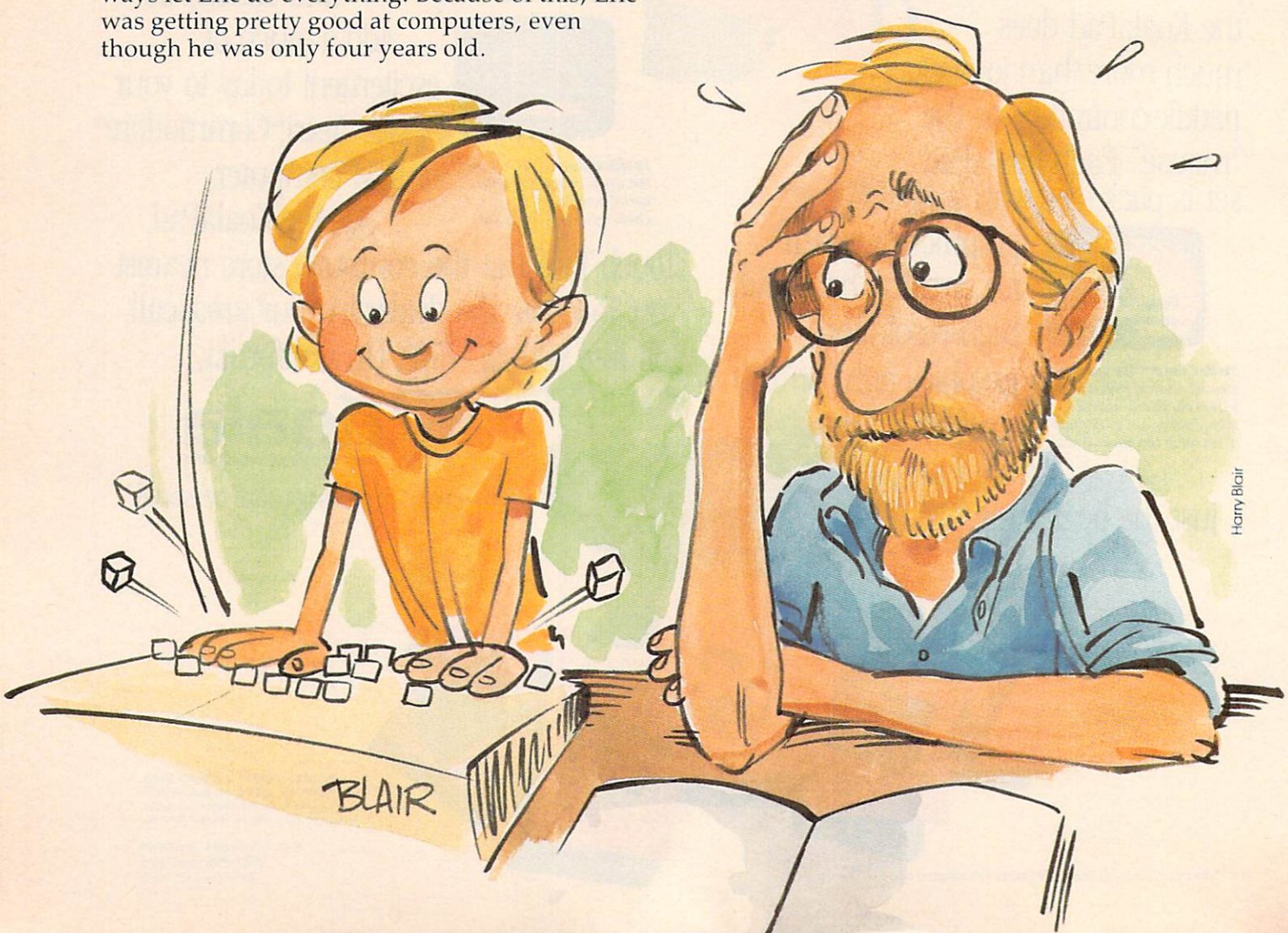
Eric's dad read the commands from the manual. He repeated the letters, one by one, and Eric typed them into the computer. When he was done, the command RUN "winnie." was on the screen. He pressed the RETURN button to send the command to the computer.

Out of the computer's speaker came the song "Winnie the Pooh," and the Pooh bear himself appeared on the screen. Beside him was a big, yellow, blinking question mark.

Just then the telephone rang, and Eric's dad took off. "I'll be right back!" he called.

"Sure," Eric thought. "In about a million years."

Eric didn't feel like waiting a million years. Besides, he knew what to do next, even without a manual. When he saw a question mark on the



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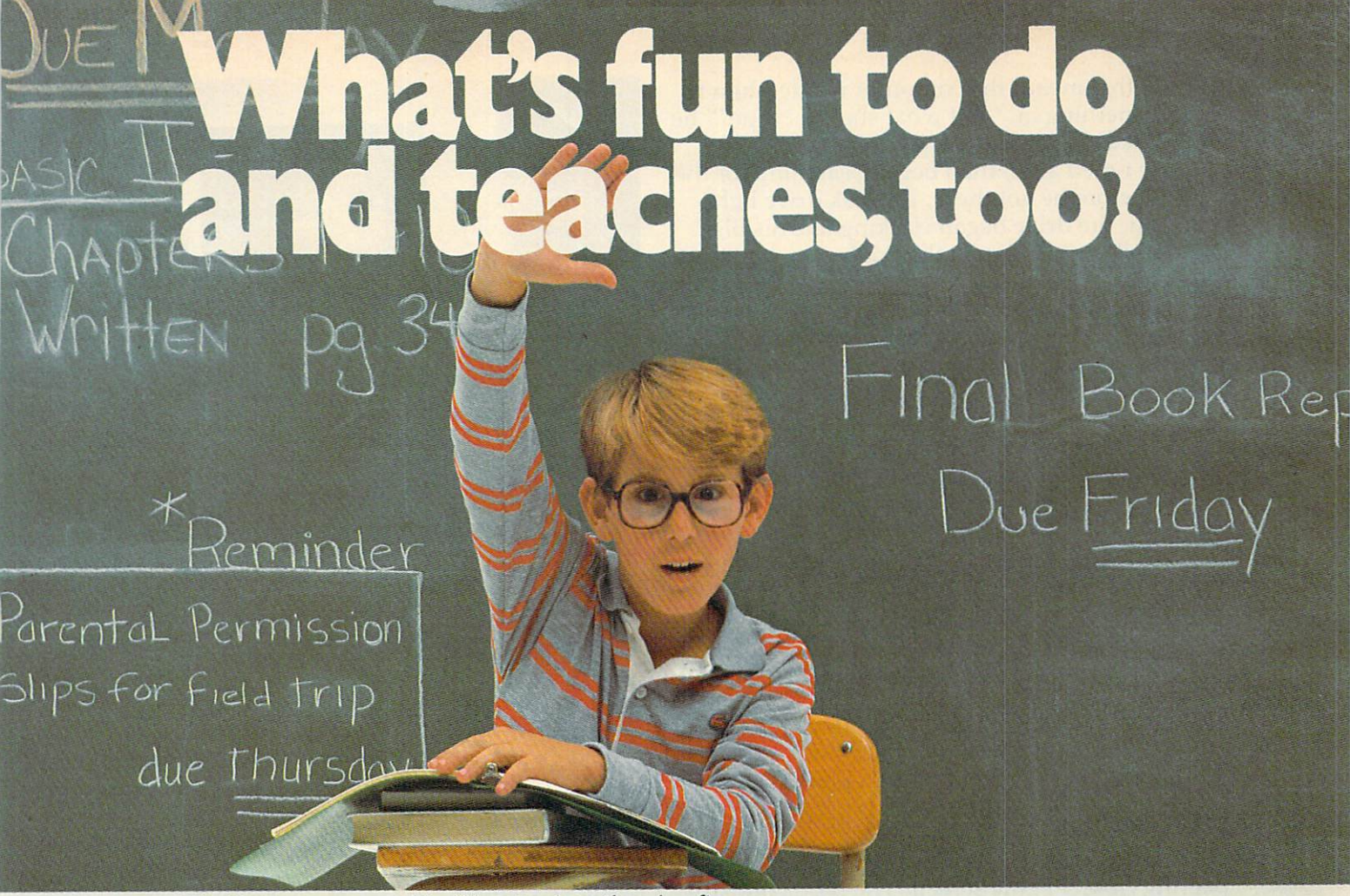

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screen, that meant the computer wanted him to type something in. "But what should I type?" he wondered. He picked his favorite word: ERIC.

He typed an E, then began searching for the R. But before he got there, the disk drive light came on, the drive began clacking like his Big Wheel bike, and Winnie the Pooh vanished from the screen.

A moment later, a new screen appeared. It was divided into several rectangles, each a different color. The Winnie the Pooh character, Tigger, appeared in the upper left-hand corner of the screen. In the upper center portion of the screen, two E's appeared — one uppercase and one lowercase. On the right-hand side of the screen was an elephant. In the lower left-hand corner of the screen was a yellow box. The box was empty.

All these things appeared on the screen, but Eric didn't notice. He was still busy typing his name. He typed an I and a C, then he looked up.

His dad sailed back into the room. He looked at the screen. "Hey, that's great, Eric," he said. "How'd you do it?"

"By typing my name," Eric answered, not sure whether to be proud or puzzled. "It made an E, but it didn't make an R. Or an I. Or a C."

I Know What To Do!

"I wonder what we do, now," his dad said, peering closely at the screen. The NEC company had sent Eric and his dad about ten pounds of computer manuals to assist them on the computer. But the two of them rarely used manuals, especially when they were just getting started. The fun part of running new programs was to see if they could make them work without reading the instructions.

Eric's dad was naturally cautious around computers. He tried to figure out which button might make the program do something.

Eric had a better approach. When he didn't know what to do next, he pressed *all* the buttons.

His strategy worked. After only a few seconds and a couple of dozen buttons, he found one that did something. He pressed the DEL (Delete) key, and the empty yellow rectangle in the lower left-hand corner of the screen turned blue. He pressed the button again and it turned red. Then it turned green. Each time he pressed the button, it turned a new color.

When Eric pressed the E key, the computer played a little more of the Winnie the Pooh song then went back to the picture of Pooh and the big question mark.

"Hey!" Eric said. "E makes a picture. Then E makes the picture go away."

He pressed some more keys. He eventually made it up to the orange function keys on the top of the keyboard. When he pushed the F4 key,

This screen appears after the boy has typed the letter "J." The Winnie the Pooh character is Kanga. When the boy draws on the touch panel (in the lower corner, on the far right), his picture will appear in the box in the lower lefthand corner of the screen.

Winnie the Pooh, Tigger, and Rabbit appeared on the screen and, with musical accompaniment, waved goodbye.

"Oh, terrific!" said Eric's dad, more than a little distracted and disturbed by Eric's shotgun approach to using the computer. "Now you've terminated the program, and we've only gotten to see one letter."

Eric was momentarily stymied. But at the moment he felt like he could do anything — the way he felt when he was rustling up a jellybean, Cheerio, and dry-noodle stew in the kitchen, or tying his shoes, or stirring up Mowie's breakfast of gooky cat food and kibbles. He surveyed the keyboard. Then he was ready. "I know what to do," he said confidently, and began pressing all the keys at the same time.

He got to the F5 key and pressed it. Winnie and his friends disappeared. The title frame came back on. He had restarted the game. He looked up at his dad. "See?" he said.

All It Takes Is Teamwork

Eric and his dad worked well as a team. With their combined brainpower and Eric's penchant for button pushing, they soon figured out how to use the rest of the program.

For example, when Eric pressed the F1 button, the NEC thermal printer started making noises like a tire spinning on ice, and paper started creeping out with a copy of the picture on the computer display screen.

Eric loved this part. Printing pictures was so easy! Very quickly, his bedroom floor filled up with 4-inch by 4-inch scraps of paper featuring all the Pooh characters and creatures whose names began with every letter from A to Z.

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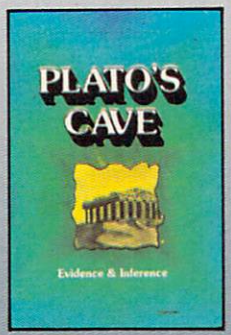

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Solving The Mystery Of The Blank Box

The blank box in the lower left-hand portion of the screen was the greatest challenge. Even when Eric printed out the display screen, the box was empty. Why was it empty? Either the program was broken and the box was supposed to have something in it, or Eric and his dad were supposed to put something in the box themselves.

They tried using the joystick. That didn't work.

They pressed all the keys on the keyboard again. No luck there, either.

They were about ready to give up and peek at the Winnie the Pooh program's instructions. Then they figured it out. They could fill up the box by drawing things on the NEC Trek touch panel, a flat drawing tablet that reproduced a copy of a picture on the computer's display screen.

The touch panel freed Eric from the computer keyboard. And that's when the real fun started!

His dad went into his study and cut up lots of pieces of paper to fit on the touch panel. Two flexible magnetic strips held each piece of paper on the panel so it wouldn't move about.

Eric climbed on the metal truck and, on top of his dresser, found the black felt-tip marker that NEC had supplied with the touch panel.

He began drawing on the panel. He drew circles, triangles, straight lines, and random squiggles. Then, satisfied with his artwork, he pressed the F1 button and printed his picture — complete with a letter of the alphabet (in upper- and lowercase), a picture of an animal whose name began with that letter, and a character from Winnie the Pooh.

Eric then took the pictures he had just drawn and put them onto the touch panel. He created new pictures by tracing the animals and letters on the old pictures. He created drawings that looked reasonably like Winnie the Pooh, skeleton hands, elephants, alligators, and birthday cakes.

For Eric this was a thrill — such a thrill that he drew pictures on the touch pad, picture screen, and thermal paper for another two hours. And the next morning, when he woke up, it was the first thing he wanted to do, even before his all-important bowl of Cheerios.

Drowned In Alphabet Pictures

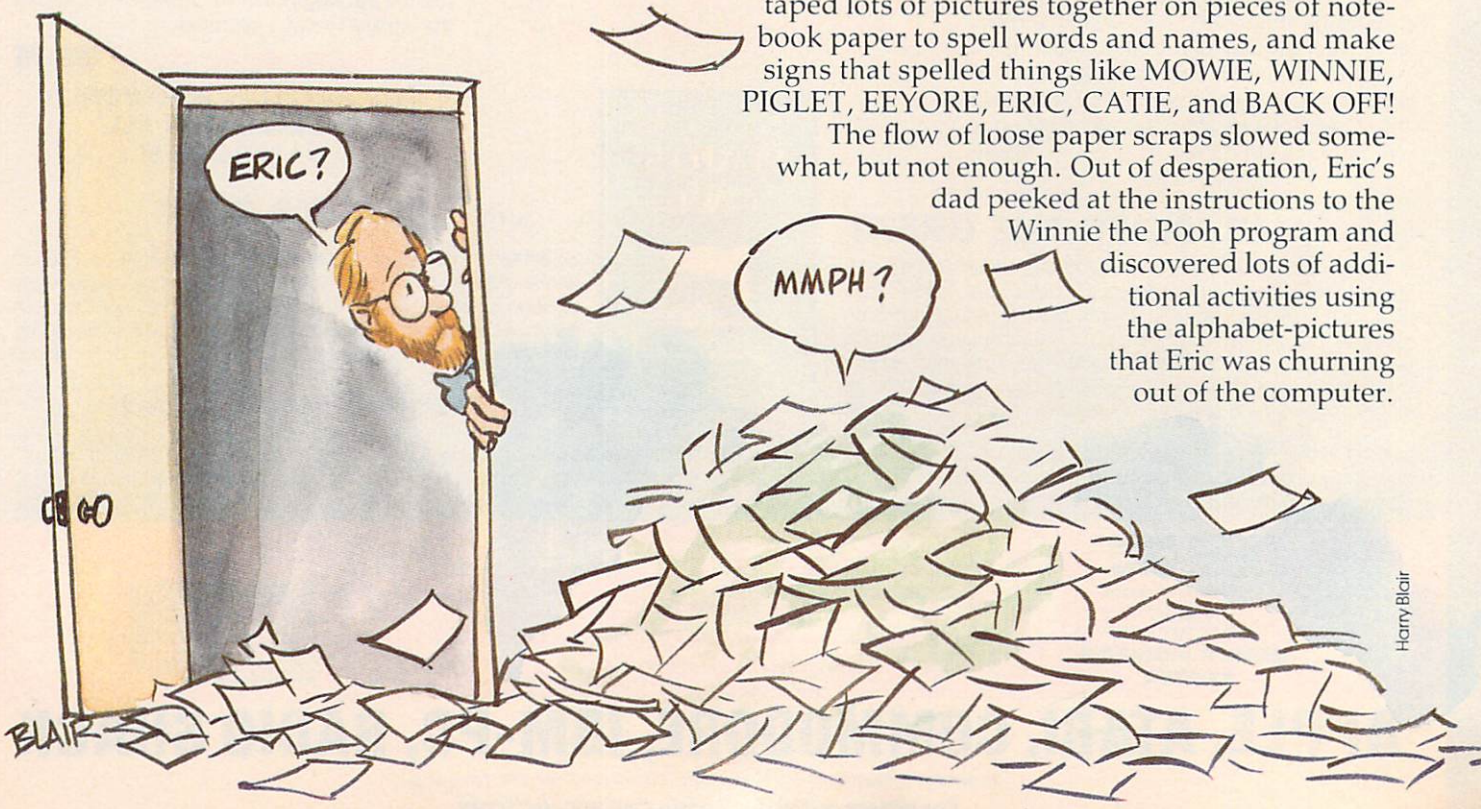
The night before, after the first hour, little scraps of paper were all over Eric's bedroom. Eric wanted to create a picture for each of his pets (his robot Denby, his puppy, and his kitty), for each member of his family and all his friends. Each picture had the first letter in the name of the person or creature it was going to.

Paper scraps flooded the bedroom, and his dad grew alarmed. He had visions of being drowned by Pooh pictures. He suggested that Eric try to group the papers into piles.

To his dad's relief, Eric came up with the idea to make "books" out of several of the pictures. The letters could be grouped together to make alphabet books, or to form the complete names of his mother, father, sister, grandparents, cousins, and his pets, creatures, and friends.

He and his dad got busy and turned Eric's bedroom into a miniature printing company. They stapled the pictures together into books, and they taped lots of pictures together on pieces of notebook paper to spell words and names, and make signs that spelled things like MOWIE, WINNIE, PIGLET, EEYORE, ERIC, CATIE, and BACK OFF!

The flow of loose paper scraps slowed somewhat, but not enough. Out of desperation, Eric's dad peeked at the instructions to the Winnie the Pooh program and discovered lots of additional activities using the alphabet-pictures that Eric was churning out of the computer.



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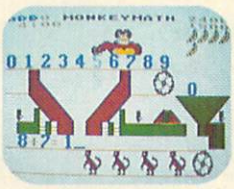

Monkeymath
by Dennis Zander

Of course Monkeymath helps give your child a better understanding of addition, subtraction, multiplication and division. That's the part *you'll* like.

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In fact, in a recent issue of Antic magazine, David Plotkin called Monkeymath ". . . one of the most entrancing educational games ever written." (And Monkeynews™ and Monkeybuilder,™ our soon to be released reading comprehension and word recognition games will be every bit as entrancing.)

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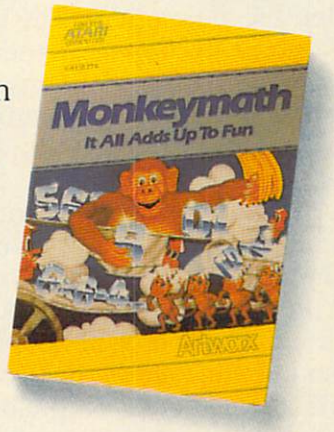

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Buying A Ticket To The Magic Kingdom

Walt Disney software runs on the NEC Trek computer (also known as the PC-6001A). Here are the prices of the components of a minimal NEC Trek system that will take full advantage of the software's features:

NEC Trek Computer (PC-6001A)	$349.95
Disk Unit (PC-6031A)	549.95
Data Recorder (PC-6082A)	99.95
Expansion Unit (PC-6011A)	99.95
Extended BASIC Cartridge	49.95
32K ROM/32K RAM Cartridge	49.95
Touch Panel (PC-6051)	149.95
Thermal Printer (PC-6021A)	249.95

Of course, you will also need a monitor or TV set to run the Walt Disney software.

The NEC Trek is an excellent home computer *system*. It is attractive, its full-sized keyboard has a nice touch, and the display on computer screen is beautiful: Large white characters are displayed on a rich green background, and helpful function keys are displayed, as a reminder, at the bottom of the screen. The system's components are equally attractive and are reliable, easy to attach, and easy to use.

But do you need all the components above to run the Walt Disney software?

You need most of the components, but not all. The Walt Disney software will be sold on cassette and disk, so you need to buy a data recorder ($99.95) or a disk unit ($549.95), but not both. The data recorder is the way to go if you have a tight budget, but I don't recommend it. The Disney software takes up a lot of space in the computer's memory. Loading the programs from cassette will be tedious and time-consuming — not the way to get started on a fun learning activity with your child.

In addition, you do not need the touch panel ($149.95) or the thermal printer ($249.95) to make the software run. However, if you elect to go this low-budget route, I think that you'd be better off (in the case of "Winnie the Pooh's Alphabet Adventures") with an inexpensive alphabet book for your child. The touch panel and the thermal printer are the keys to making the software interactive and a joyous experience for a young child (see my accompanying review with my four-year-old son Eric). Young children can use the touch panel and the thermal printer and create *their own* alphabet books.

Winnie the Pooh's Alphabet Adventures will be part of a two-program package entitled *Alphabet Soup*. The other program will be Mickey's Lucky Stars and will teach letter sequences. *Alphabet Soup* is already available. It is just the first of five Walt Disney software packages. The packages teach the letters in the alphabet, reading, writing, spelling, and arithmetic. They will also help develop a child's problem-solving, logic, and fine motor abilities. Each package will cost $34.95 (disk or cassette).

I will review the forthcoming Disney packages in future issues of COMPUTE!. The reviews will appear about the time that each package is released. Here are the titles of all the packages and programs:

Alphabet Soup (Ages 3 – 7)
- Winnie the Pooh's Alphabet Adventures
- Mickey's Lucky Stars

Goblins & Galaxies (Ages 9 – 14)
- Minnie and the Haunted Mansion
- Goofy in Space

Mathemagical Maze Craze (Ages 7 – 12)
- Cinderella's 3-D Maze
- Mickey's Mathemagical Mops

Race To The Arcade (Ages 7 – 14)
- Donald's Word Arcade
- Dalmation Multiplication

Countdown Carnival (Ages 7 – 10)
- Mickey and the Beanstalk
- Cinderella's Beads

If you want to learn more about the NEC Trek (PC-6001A) computer and the Walt Disney software, write or call:

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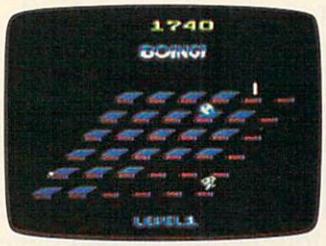

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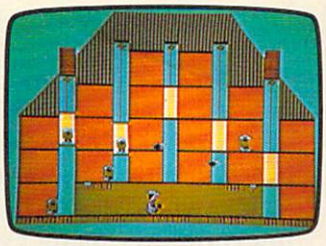

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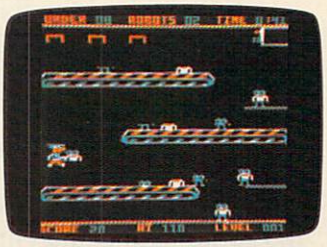

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They began to use the pictures as alphabet flash cards and played lots of games, including Concentration (guess the missing letter), Scrambled Letters (trying to reorganize letters to make up a word), Letter Match (matching up lowercase and uppercase letters), Tasty Letters (matching up flash cards with alphabet cereal letters), Alphabet Clothes Line (taping the letter pictures to a string hanging in the room), Mystery Letters (letting Eric run his fingers along the clothes line, and trying to guess which letter he is pointing to).

The Winnie the Pooh user's guide even had a short BASIC program to type in to create a new game. Eric and his dad typed in the game. It was a Mystery Letter game. It typed a sequence of letters on the computer's display screen, but one letter was missing. Eric had to guess the missing letter. If he got the letter right, his dad let him print the letter out on the computer printer.

Typing With His Toes

The more Eric used the Winnie the Pooh program, the more relaxed and creative he became. In the beginning, he sat stiffly in front of the computer keyboard and picture screen, held the touch panel in his lap, and drew on sheets of paper. But by the end of his first session things had changed drastically. His dad lay on his side, sprawling behind Eric, watching him draw his pictures. Eric decided he wanted to get more comfortable, too, so he climbed up on his dad, using him as a reclining lawn chair. He stopped using the paper and marker to make pictures and, instead, began drawing pictures with his finger on the white, glossy plastic surface of the touch panel. It was like electronic finger painting, and he loved it!

When Eric climbed on his dad the first time, he accidentally kicked the Expansion Panel on the side of the computer. Loaded in the Expansion Panel were a RAM cartridge and the Extended BASIC cartridge needed to run the program. When the Expansion Panel became dislodged, the screen went blank and the program disappeared.

Eric pushed the Expansion Panel back against the computer, but he didn't want to reboot the disk (he'd already done that before), so his dad had to do it. While the program was reloading, Eric did backward somersaults across the bedroom floor.

His dad lay back down. Eric stopped doing his somersaults and climbed onto his dad again. As he was making himself comfortable, he pulled the cord out of the touch panel. His dad saw the cord fall off, but he didn't say anything. Eric spent about a minute making a drawing with his finger before he looked up at the computer's picture screen. The little picture box was still empty.

Eric pushed all sorts of buttons on the computer before he realized that nothing was happening because the touch panel was no longer connected to the computer. This prompted his dad to deliver a little lesson on computer cables as "highways" for the computer's information to zoom back and forth from the computer to peripherals like the touch panel and the printer.

Eric and his dad also discussed the pins on the ends of the cables, so that Eric would know the proper way to plug the cables into the computer and the other equipment.

Eric got the touch panel hooked up. He climbed back up on his dad, dug his elbow into his dad's rib cage, and began drawing. But now the touch panel was upside down. This appealed to him. Everything he did on the touch panel showed up backwards and upside down on the picture screen.

He tried typing the letters in his name. He tried making numbers. He made faces, houses, and robots. Everything appeared on the screen backwards and upside down.

Eric turned the touch panel on its right side and drew pictures. Then he turned the panel on the left side. Then he turned the touch panel over and tried to draw pictures on its bottom. When he found that this didn't work, he improvised by drawing a picture with his knee.

When he was done drawing, he said, "Daddy, please press the print button."

"Phooey!" his dad said. "You're lying on me. How am I supposed to press the button?"

"Please, Daddy?"

When his dad heard that "Please, Daddy?" he couldn't resist. "I'll see what I can do," he said. He looked down at the computer. His bare, sockless foot was only a couple of inches to the left of the keyboard. He lifted his leg carefully (so as not to dislodge Eric and his touch panel) and stretched his big toe toward the F1 button on the keyboard. He missed. The computer made haunted house music to show that he had pressed the wrong key.

He tried again. This time his toe hit the right button. The printer started chugging away and printed Eric's picture.

"Wow!" Eric said, impressed by his dad's display of pedal dexterity. Unfortunately, this gave Eric ideas. It opened his eyes to new ways to interact with computers. He knew that using his fingers was OK, and his sister had once operated her computer using her tongue. But he had never considered using his toes. Until now.

The rest of the evening Eric practiced pressing all the buttons on the NEC Trek with his toes.

He did pretty well, too. And his dad let him do it. But his dad created one rule that Eric had to obey. Before he could continue using the computer, he had to submit to a thorough sponge bath of both feet. ©

Books&Software

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Learning With Computers

Glenn M. Kleiman

Are you interested in learning the Logo language? Or have you already begun using Logo or teaching it to others? If so, have you or your students encountered any confusion that was frustrating and delayed progress? Would you like more guidance in understanding and explaining what you have heard called the "powerful ideas" inherent in Logo? Do you want to go beyond simple turtle graphics commands and explore more complex procedures, recursion, and language processing? Would you like suggestions from a Logo expert who is also an experienced teacher of the language? If you have answered yes to any of these questions, then I recommend that you get a copy of *Learning with Logo* by Daniel Watt (McGraw-Hill, 1983, $19.95).

I have used the version of this book designed for MIT (that is, Terrapin or Krell) Logo for the Apple Computer. It contains an appendix explaining differences between MIT Logo, Apple Logo, and TI Logo. Another version of the book is available specifically for users of Apple Logo. Versions for Atari Logo and Commodore 64 Logo are forthcoming.

Learning with Logo is designed to be used with a preprogrammed disk. The disk contains "tool" procedures that can be used as if they were built-in Logo commands. These procedures support many of the lessons in the book. The disk also contains longer programming examples so you can explore them without first typing them. You can order a copy of the disk for Apple, MIT, or TI Logo. The cost is $15.95, and the author gives permission to make a copy of the disk for anyone else who has purchased the book. All the procedures on the disk are given in an appendix of the book, so you can also type and save them on a disk yourself.

A Wealth Of Information

Learning with Logo is 365 pages long, divided into an introduction, 14 chapters, 4 appendices, and an index. Each chapter begins with a list of the commands and procedures introduced in that chapter, and then gives explanations and examples of how they can be used. The book is well illustrated with clever cartoons and pictures of what you should see on the computer screen as you work through the examples.

Chapter 1 gets you started with Logo. It explains how to load Logo into the computer, use the keyboard, and enter commands. It also introduces the turtle and the FORWARD, BACKWARD, LEFT, and RIGHT commands. Chapter 2 covers the remaining turtle graphics commands.

Chapter 3 contains two special turtle activities called Shoot and Quickdraw. They are ready to load and use. How they are programmed is discussed later in more advanced chapters.

Shoot is a simple game. The computer draws a target in a randomly selected position on the screen and places the turtle elsewhere. The player uses LEFT and RIGHT commands to turn the turtle directly toward the target and then specifies how far forward the turtle should move to reach the target. This game is designed to help children learn to estimate angles and distances.

Quickdraw is a simple drawing tool. There are six simple commands: F moves the turtle forward 20 steps; B moves it backward 20 steps; R turns the turtle 30 degrees to the right; L turns it 30 degrees to the left; E ends the drawing and lets you give the picture a name; and RD followed by a name of one of your pictures tells the computer to redraw it. Quickdraw is usable by young children and introduces some of the major concepts of Logo, including building complex shapes out of simple building blocks.

Chapter 4 explains how you can teach the computer new Logo procedures. It also explains how to use the Logo screen editor and how to save procedures on a disk.

Chapters 5 and 6 further elaborate the use of turtle graphics commands and procedures. It presents sample projects in which Logo procedures are used to create designs and pictures.

Chapter 7 introduces the important concept of variables. It also covers some of the ways procedures can be programmed to interact and exchange information. This includes an explanation of recursive procedures.

Chapter 8 further explores the concepts introduced in Chapter 7. It explains a procedure called POLY, which is used to draw polygons. POLY has two variables: SIZE (of a side) and ANGLE (number of degrees). Many different patterns and designs can be created by changing these variables and recursively repeating the POLY procedure.

Chapter 9 introduces the fundamental commands for working with numbers, words, and

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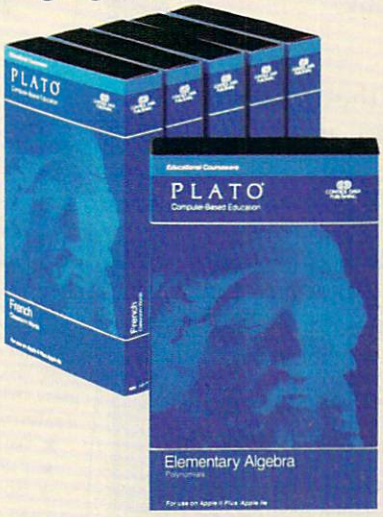

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lists. These complete the basics needed to begin working with the four larger projects described in Chapters 10 through 13,

Chapters 10 and 11 explain in detail the programs for the Shoot and Quickdraw activities introduced in Chapter 3. The project in Chapter 12 is a race-track game which shows how simple animations can be created. The final project, described in Chapter 13, uses the list-processing commands for working with language. The program has the computer randomly select words from different sets and combine them into sentences and "poems."

The final chapter explains how the special tool procedures on the disk operate. These include procedures for drawing circles and arcs, determining the distance between the turtle and a specified point, counting the number of letters in a word or words in a list, and several others.

The appendices explain how to create your own disk of the procedures used in the book; discuss the differences among MIT, Apple, and TI Logo; explain the use of disks and files; and present a summary of Logo commands.

As this description of the chapters suggests, the book contains a wealth of information about Logo. The early chapters are suitable for complete beginners while the later ones explain sophisticated programming techniques. The book goes well beyond turtle graphics to explain how Logo can be used with numbers, words, and lists. The examples and discussions are all clearly and carefully presented. The material is well-sequenced, with the lessons and programs in each chapter building on what was learned in prior chapters. The many illustrations aid both understanding and interest. And I have not yet described what I regard as the best features of this book.

Helpful Cartoon Symbols

Special cartoon symbols mark what the author calls *pitfalls*, *explorations*, *powerful ideas*, and *helper's hints*. Each symbol marks information that goes beyond the description and explanation of Logo to provide additional guidance and insight.

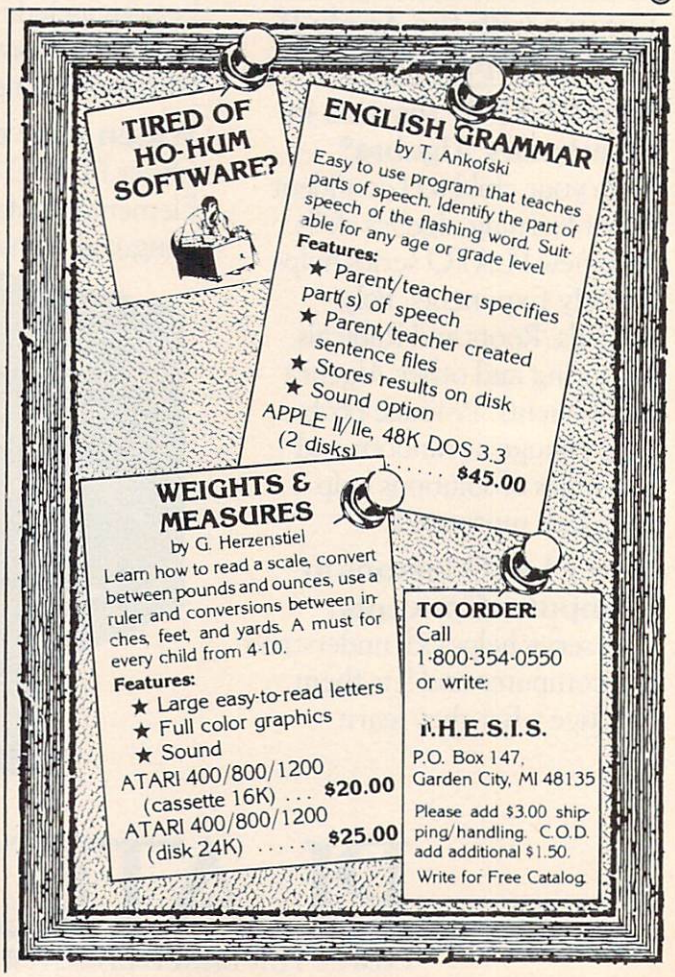
Pitfalls are confusions or difficulties that many people encounter while learning Logo. The pitfall symbol (a turtle which has fallen into a trap) marks explanations that will help you avoid or get out of pitfalls. Some pitfalls are simple reminders for beginners, like putting a space between a FORWARD command and the number of steps the turtle is to move. Others, such as pitfalls in using recursive procedures, are for more advanced users of Logo.

Powerful ideas help you think more clearly and solve problems with the computer more easily. Some of these ideas, such as dividing a complex problem into a series of simpler ones, will also help you solve problems that do not involve the computer at all. A cartoon symbol of a turtle with a bright idea designates explanations of powerful ideas. These explanations are important for helping learners see the general principles while they work with specific examples.

Explorations are necessary to become proficient with Logo, but most learners need suggestions for things to explore. These are provided throughout the book, marked by a picture of a turtle with a map and spyglass. Many of the explorations are suggestions for modifying and extending programs given in the book.

Helper's hints explain difficult points and pitfalls more fully, suggest learning activities, and give other practical suggestions for teaching. These are marked by a symbol showing two turtles — an older and a younger one — helping each other learn by shining a bright light on the subject. Helper's hints can help you learn more about Logo and help you teach others.

Daniel Watt, the author of *Learning with Logo*, is a former researcher with the MIT Logo group and an experienced Logo teacher. The clarity, organization, and special aids in this book reflect both his expertise with the language and his abilities as a teacher. *Learning with Logo* comes closer to bringing a master teacher to your side than any other book I have seen. ©



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The Electronic Chalkboards: The BBC And The Powerpad

The Only Computer To Have When You're Having More Than One

Last spring I went to London and taught a course on robotics literacy. According to the *Daily Telegraph*, the classroom where we met was like a "composite of several scenes out of *Dr. Who*." We had robot turtles and robot buggies rolling around on the floor, and robot arms waving and weaving on the tops of our desks. And we had 15 BBC microcomputers linked together in the BBC's Econet local area network. The students used the BBCs to control the robot arms, to learn Logo and BASIC, and to perform experiments with robot sensors.

The 15 BBCs all received their programs from a single disk drive (the *fileserver*) in the front of the classroom. They all used a single printer (the *printserver*) to type out files, programs, and student papers and assignments.

David Barnett, the course's computer instructor, used a BBC as the demonstration computer. David's BBC was connected to a large television set mounted on a shelf so all the students could see it. The computer acted like the course's *electronic chalkboard*. David ran programs on his computer, and they appeared on the big TV. Then he pressed a button, and a copy of his computer's screen appeared on the screens of all the students' computers.

The system was even more flexible than this. The students all worked on individual and team projects. When they finished their projects, they made presentations. To aid their presentations the students could send copies of their screens to all the other students' screens.

And David, in front of the class, could help individual students if they got bogged down in a program. By pressing a couple of buttons on his computer, he could take a snapshot of the screen on a student's computer. After studying the student's problem, he could take control of the student's keyboard and type in a command or piece of information. The student could watch all this on his or her own screen. A moment later, David would return control to the student, and the student could resume running the program on his own.

This was a tremendous feature. When I am teaching a course and a student asks me a question, I often have to sit down at the student's computer in order to decide what is going on and what to suggest. If you have 15 students, and they are all asking questions, it can get pretty hectic running from computer to computer.

The BBC network eliminates this problem. You can stay seated at your own computer and, with the push of a button, you can "hop" to any student's computer, diagnose his or her problem, and enter the appropriate response. This feature alone, in my opinion, makes the BBC network extremely valuable.

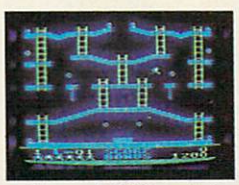
The Only Computer That Majors In Education

Acorn Computers Ltd. sells the BBC computer in England. Its subsidiary, Acorn Computers Corporation, is now selling the BBC in the United States. Acorn can be reached at:

Acorn Computers Corporation
400 Unicorn Park Drive
Woburn, MA 01801
(617) 935-1190

The company is concentrating its efforts exclusively on the $700 million US education market. Two years ago, the Acorn computer won a contest sponsored by the British Broadcasting Corporation and was given permission to name its computer the BBC. Acorn has since sold BBC computers to 85 percent of British primary and secondary

JUMPMAN'S A GREAT GAME. BUT YOU'VE GOT TO WATCH YOUR STEP.



Meet the Alienators. A fiendish bunch who've planted bombs throughout your Jupiter Command Headquarters.

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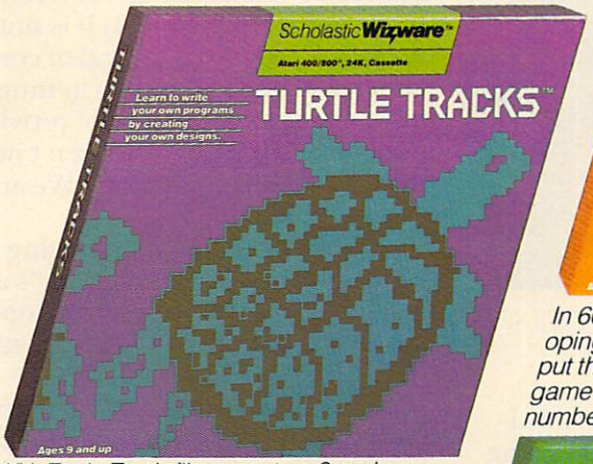

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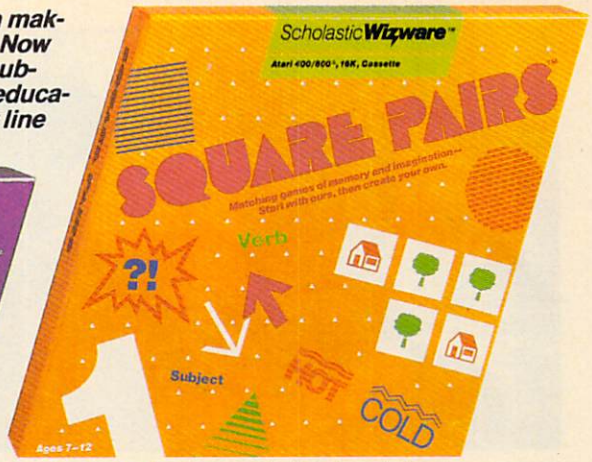
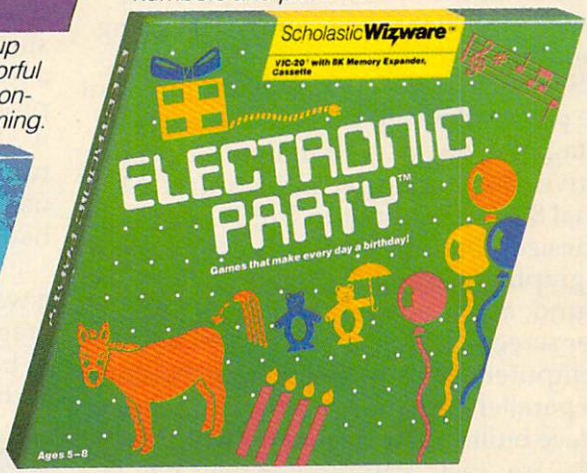


In 60 years we've learned a lot about developing kids' reasoning and math skills. We've put this know-how into Square Pairs,™ a game in which children 5 to 8 match words, numbers and patterns.



There's nothing like a learning party to get kids excited about education. That's the idea behind Electronic Party,™ a maze game in which children 5 to 8 also create original computer graphics.

Microzine™ is an innovation in computer education—a programmed magazine that kids read, "talk" to and help write. It stimulates creativity in children 10 and up.*

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Five-year-old Jessica Harvey is playing a BBC learning game called Missing Signs.

schools. This amounts to 150,000 computers already installed and 30,000 new computers going out each month.

The US version of the computer is equivalent to the more powerful BBC/B version. For the hefty $995 price tag, you do *not* get a monitor, a printer, or a disk drive. But you do get 64K RAM/ROM, an additional 80K ROM, built-in BASIC, a (TI) voice synthesizer, built-in word processing, high-resolution graphics (640 x 200 pixels), multi-channel sound, and a software switchable 40- or 80-character screen.

The computer comes with either an RS-423 or Centronics parallel port and with the Econet network interface built-in. The actual network, including software, costs $595, and enables you to connect up to 254 computers on an inexpensive, four-wire, telephonelike cable. The 6502 processor can be augmented to include an additional 6502 processor, or a Z80, or 32-bit National Semiconductor 16032 processor.

A 440K disk drive costs an additional $545; an 800K disk drive costs $995. Acorn offers a monochrome monitor for $195. The computer will support any of the popular printers, over the serial or parallel ports.

I know from having used the computer in England that the operating system and the computer's version of BASIC are a programmer's delight — extremely powerful yet simple to use. But Acorn's marketing strategy in the US will focus on the software that has been developed for the machine. Two hundred fifty educational packages have already been created for the BBC and approved by Acorn's prestigious nine-member Educational Advisory Board.

In addition, 2,500 software companies produce software for the BBC in England and in Western Europe. Many of these companies are modifying and enhancing their packages so they will meet the board's approval and be available on the US version of the machine.

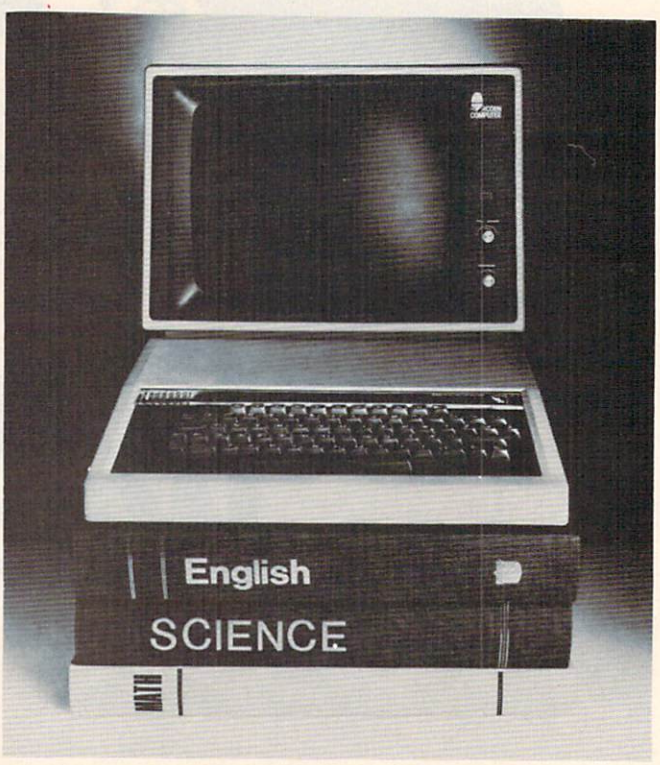
We Give Courses On How To Give Courses

According to Harvey Lawner, general manager and senior vice president of Acorn (US), "Education is our main business. It is not an afterthought." Lawner is critical of computer companies that concentrate on getting a computer into a classroom, but do not provide direct and immediate support. "We aren't just selling a computer," Lawner contends. "We are selling a total learning system."

Lawner's national marketing director, Bob Angelo, contrasts his company's approach with the hardware-first approach adopted by other American companies. "They're selling boxes," he says. "We're selling solutions."

For an educational software package to be approved by the Educational Board, it must be supported by a lesson plan, a student's workbook, a teacher's guide, student notes, and (when appropriate) student experiments. This *print component* forms an integral part of Acorn's effort to turn the computer into a tool that any teacher can use no matter how little experience he or she has had with a computer.

Acorn's philosophy is to package the BBC in a way to make it as familiar as possible to the average teacher. The software, for example, comes in boxes that look like quality, hardcover, linen textbooks.



Acorn Computers Corporation is trying to make the BBC computer look familiar and nonthreatening to teachers. Even the software is packaged to look like classroom textbooks. (Please note: The "books" in this photo are oversized.)

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According to Angelo, Acorn isolated two problems which have inhibited the introduction of microcomputers in the classroom. First, most of the software currently appearing in the classroom is often three to four years old, or even much older. The old software does not reflect the newest philosophies in educational computing and does not make use of the advanced hardware capabilities of the newer microcomputers.

Second, computers in school are being used only by a relatively small number of teachers and students. Most teachers are fearful of the computers and don't see how a computer can make a valuable contribution to their own teaching.

Angelo says that Acorn will attack both these problems head on. First, Acorn is commissioning the development of a huge quantity of new software for use in classrooms on the BBC computer. Second, the Acorn board is helping software companies to translate to the BBC the best new software currently running on other machines.

Chalk Board's PowerPad

Last week I flew to New York and got a chance to preview one of the most exciting new products on the market — the PowerPad, a touch-sensitive tablet in a 20-inch-by-17-inch hard plastic case. The PowerPad plugs into VIC-20, Commodore 64, IBM PC, Apple, and Atari computers.

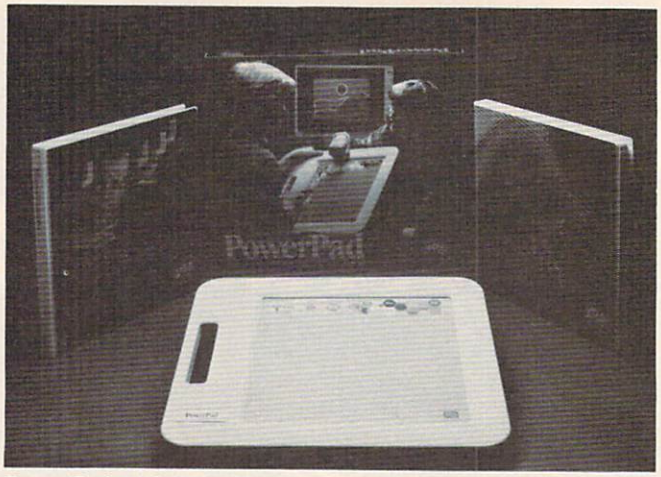
The PowerPad can replace the keyboard as the primary means of inputting information into the computer, especially for children. It has numerous mylar overlays which easily clip on top of the 12-inch-by-12-inch touch-sensitive pad. Each overlay is a new keyboard, a keyboard with colorful shapes and figures.

The PowerPad has only a few "keys" on each overlay, so the child or the beginning user isn't overwhelmed by choices.

The "keys" are large and in bright primary colors. Printed on them are bold words (RED or PLAY) and symbols such as # or *. They are separated by plenty of space to make typing simple.

The PowerPad features a novel design in which signals from the tablet are digitally sensed and encoded. A grid of 14,400 contact points (100 points per square inch) is sandwiched inside the PowerPad. The points can record one contact at a time or a dozen contacts. Older touch pads can sense only one finger at a time. But kids (and adults) can put *all* their fingers on the PowerPad at the same time, and the PowerPad will sense all of them and transmit the proper signals to the computer.

This capability is especially nice with the PowerPad's music software and overlay, *Micro Maestro*. The overlay has a piano keyboard at the bottom and a musical score in the middle, with colorful "buttons" for each note on the score. A child can play a musical chord on the piano keyboard by pressing all three fingers on different keys at the same time. This would be impossible on any other touch pad.



PowerPad with its 12 × 12 inch touch-sensitive surface, and two selections from Leonardo's Library, MicroMaestro *and* Leo's 'Lectric Paintbrush.

Another software-and-overlay package, *Leo's 'Lectric Paintbrush*, helps a child create colorful pictures on the computer. Again the multicontact feature of the PowerPad becomes especially useful. Before drawing each new part of the picture, the child can press the Pen Up button on the upper left-hand corner of the PowerPad. Immediately a pen tip appears. The child can change the color of the ink being used by pressing one of the colorful paint keys on the upper right-hand corner of the

This family is using the PowerPad with the overlay for Leo's 'Lectric Paintbrush, *which allows you to "paint" colorful pictures on the computer screen with your finger. Using the "buttons" at the top, you can create shapes, move them around on the screen, create copies, and then save an entire screen onto tape or disk.*

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Robert H. Ranson, President of Chalk Board, showing the PowerPad fitted with the MicroMaestro *overlay.*

board. When the child picks a new color, the color of the pen tip changes to that color.

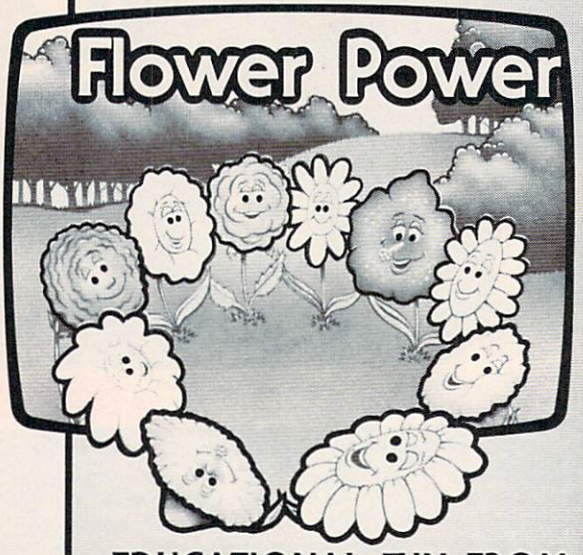
Leonardo's Library

The PowerPad costs $99.95. It is supported by a large and growing body of educational software, called Leonardo's Library. Programs in the library will cost between $25 and $50. The library will include programs focusing on visual arts, music, math, science, language arts, and social studies. Included among the first programs are:

- *Leo's 'Lectric Paintbrush.* An electronic finger-painting kit.
- *Micro Maestro.* Turns the PowerPad into a piano keyboard.
- *Music Math.* Lets children explore the relationships between math and music.
- *Programmer's Kit.* Lets older children and adults write their own software and develop their own creative uses for the PowerPad.

PowerPads and programs in Leonardo's Library are already available at K mart, Apple Computer dealers, and many other computer and discount stores. If you would like to know more about the PowerPad, you can contact Chalk Board directly:

Chalk Board, Inc.
3772 Pleasantdale Road
Atlanta, GA 30340
(404) 496-0101



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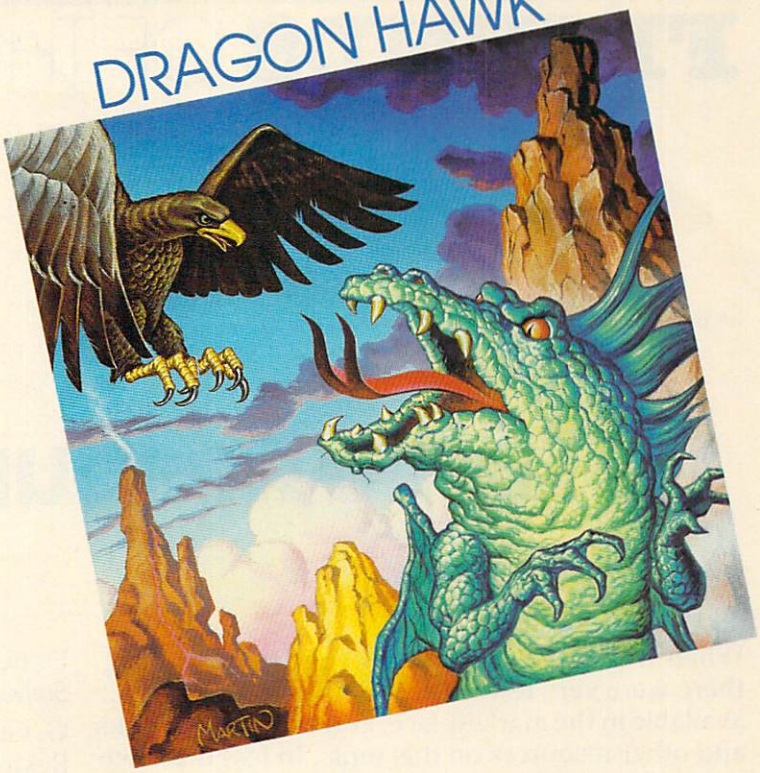

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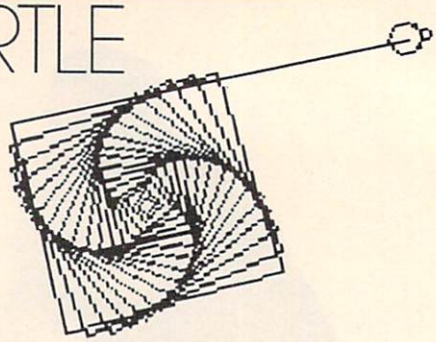

David D. Thornburg, Associate Editor

A Turtle Resource Update

When we started "Friends Of The Turtle" in 1982, there were very few turtle graphics languages available in the marketplace, and even fewer books and other resources on this topic. In less than two years, the number of turtle-based activities and resources has exploded. Because many of you may not be able to keep up with all the activity in this area, I thought that it might be a good time to update the turtle resource list.

As hard as I try, I know this list will be quite incomplete. It's almost impossible to be completely up-to-date, so, if you have written a book or language that specifically relates to turtle graphics or to languages such as Logo, and it doesn't appear on this list, please send me a copy for review. I only write about things I have seen with my own eyes — a habit that is essential in this dynamic industry.

Books

There are several books on turtle graphics available today, with new titles available every month or so. Because of the considerable interest in turtle graphics by young computer users, I have labeled each entry with a level. Generally, Level A books are suitable for kindergartners through fourth grade, Level B books are for fifth grade and up, and Level C is for college through adult readers.

H. Abelson, *Logo for the Apple II*, Byte Books/McGraw-Hill, 1982. Level C.

H. Abelson, *Apple Logo*, Byte Books/McGraw-Hill, 1982. Level C.

H. Abelson and A. diSessa, *Turtle Geometry: The Computer as a Medium for Exploring Mathematics*, MIT Press, 1981. Level C.

D. Bearden, *1, 2, 3, My Computer and Me: A Logo Fun Book for Kids*, Reston, 1983. Level A.

D. Bearden, K. Martin, and J. Muller, *The Turtle's Sourcebook*, Reston, 1983. Level A, B, C.

G. G. Bitter and N. R. Watson, *Apple Logo Primer*, Reston, 1983. Level B, C.

J. D. Burnett, *Logo: An Introduction*, Creative Computing Press, 1982. Level A.

P. Coburn et al., *Practical Guide to Computers in Education*, Addison-Wesley, 1982. Level C.

A. Goldberg and D. Robson, *Smalltalk-80: The Language and Its Implementation*, Addison-Wesley, 1983. Level C.

E. P. Goldenberg, *Special Technology for Special Children: Computers to Serve Communication and Autonomy in the Education of Handicapped Children*, University Park Press, 1979. Level C.

P. Kelman et al., *Computers in Teaching Mathematics*, Addison-Wesley, 1983. Level C.

H. Kohl, T. Kahn, and D. Disharoon, *Atari PILOT Activities and Games*, Reston, 1983. Level B.

S. Papert, *Mindstorms: Children, Computers, and Powerful Ideas*, Basic Books, 1980. Level C.

R. P. Taylor, *The Computer in the School: Tutor, Tool, Tutee*, Teacher's College Press, 1980. Level C.

D. D. Thornburg, *Picture This! — An Introduction to Computer Graphics for Kids of All Ages* (for Atari PILOT), Addison-Wesley, 1982. Level B.

D. D. Thornburg, *Picture This Too! — An Introduction to Computer Graphics for Kids of All Ages* (for Apple SuperPILOT), Addison-Wesley, 1982. Level B.

D. D. Thornburg, *Computer Art and Animation: A Guide to TI Logo*, Addison-Wesley, 1983. Level B.

D. D. Thornburg, *Computer Art and Animation: A Guide to Radio Shack Color Logo*, Addison-Wesley, 1983. Level B.

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D. D. Thornburg, *Every Kid's First Book of Robots and Computers*, COMPUTE! Books, 1982. Level A.

D. D. Thornburg, *Discovering Apple Logo: An Invitation to the Art and Pattern of Nature*, Addison-Wesley, 1983. Level B, C.

D. Watt, *Learning With Logo*, McGraw-Hill, 1983. Level B.

Computer Languages And Products

In addition to the commercial languages shown here, COMPUTE! has published versions of PILOT to BASIC interpreters that include turtle graphics. These articles started in September 1982 with a version for the Apple by Alan Poole.

Apple computers:
- Apple Logo (disk from Apple)
- Terrapin Logo (disk from Terrapin)
- Krell Logo (disk from Krell)
- Delta Drawing (disk from Spinnaker)

Atari computers:
- Atari PILOT (cartridge from Atari)
- Atari Logo (cartridge from Atari)
- WSFN (disk from Atari APX)
- Delta Drawing (cartridge from Spinnaker)

Commodore computers:
- Commodore 64 Logo (disk from Commodore)
- COMAL (Commodore 64 disk from COMAL User's Group, Len Lindsay, Madison, WI)
- Turtle Graphics II (Commodore 64 cartridge from HES)
- Delta Drawing (cartridge from Spinnaker)

IBM computers:
- Dr. Logo (disk from Digital Research)
- Delta Drawing (disk from Spinnaker)

Radio Shack computers:
- Radio Shack Color Computer (disk or cartridge from Radio Shack)

Texas Instruments computers:
- TI Logo (cartridge from Texas Instruments)

Robots:
- TOPO (remote-controlled robot from Androbot)
- RB-5X (self-contained robot from RB-Robotics)
- Hero-1 (self-contained robot from Heath)

Organizations

The following organizations provide generally nonoverlapping views into the community of users of languages like Logo.

Asociacion Amigos de Logo
Salguero 2969
1425 Buenos Aires, Argentina

Friends of LISP/Logo and Kids (FOLLK)
436 Arbalo Dr.
San Francisco, CA 94132

National Logo Exchange
P.O. Box 5341
Charlottesville, VA 22905

Young People's Logo Association
1208 Hillsdale Dr.
Richardson, TX 75081

A Note About "Friends Of The Turtle"

I have received overwhelming support from you all in the last two years. Together we have seen turtle graphics and the languages that support it move from relative obscurity to the forefront of the personal computer experience. In the beginning there was little to keep track of — and more time to help people on a direct basis. Now the vision we all shared has become reality — high quality turtle graphics environments are available on most of the personal computers on the market today. In keeping with this change, I have decided to focus all my activities for "Friends Of The Turtle" on this monthly column. As always, I want to hear from you with your ideas and programs that you would like shared with your fellow readers. Those of you wishing to join an organization that supports your interest should contact the organizations listed above. Each is excellent and can provide many valuable services to members.

Thank you for a wonderful two years — may the next years be as exciting. ©

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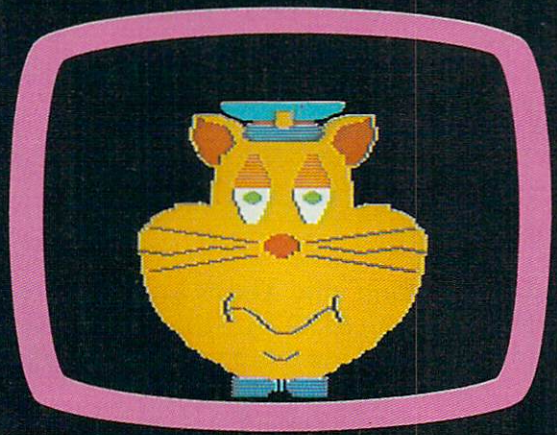

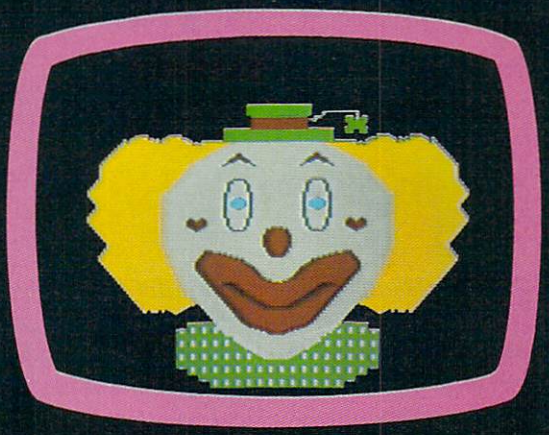

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Questions Beginners Ask

Tom R. Halfhill, Features Editor

Are you thinking about buying a computer for the first time, but don't know much about computers? Or maybe you just purchased a computer and are still a bit baffled. Each month in this column, COMPUTE! *will answer some questions commonly asked by beginners.*

Q What is the best way to mail computer tapes and disks?

A As carefully as possible.

Many tapes and disks arrive at COMPUTE! Publications every month. The vast majority survive the mails unscathed, thanks to careful packing and postal handling. But cracked plastic cassette boxes and crumpled envelopes show that some of them have had a bumpy trip.

Cassettes seem to fare better than disks because of their rigid plastic enclosures. If you need to mail only a few programs, a cassette might be safer. Be sure to use an unbreakable plastic cassette box instead of the standard Philips box.

Disks should always be mailed in the stiff cardboard mailers available at some stationery shops and computer stores.

For either tapes or disks, use a padded envelope if possible, or wrap the media with paper or foam. Plainly mark the envelope with these warnings: "Handle With Care," "Hand Stamp Only," and "Magnetic Media Enclosed — Keep Away From Electric Motors And Other Magnetic Sources." Wrapping the media with aluminum foil offers little or no protection against magnetic fields.

If you find yourself regularly mailing programs to friends, you might want to consider equipping your respective computers with modems and transmitting the programs over the phone. This is also a lot faster and sometimes even cheaper.

Q I am new to home computing. I bought an Atari 800 with a cassette recorder in September. I understand some of the advantages of disk storage versus the cassette, but would like to know some of the disadvantages, if any. I also don't understand why Atari's 810 disk drive is so expensive (about $450). Are there disk drives for this machine that are more moderately priced?

A There are a few disadvantages to disk drives as opposed to cassette recorders, but most people find the balance weighs heavily in favor of disks.

Probably the biggest disadvantage is the one alluded to in the second part of your question: the higher cost of a disk drive. Ironically, a year or two ago your question would have seemed strange to most computer hobbyists, because at that time $450 or even $550 was considered a good price for a disk drive. Since then, prices of personal computers have been dropping as drastically as were prices of hand-held calculators in the mid-1970s. However, as you've noticed, prices of certain peripheral equipment — such as disk drives and printers — have dropped relatively less. There are two general reasons for this.

First, computers are largely solid-state devices with virtually no moving mechanical parts except for their keyboards. Their major components are silicon "chips" — memory chips and microprocessors. Rapidly declining manufacturing costs for chips account for much of the computer price-cutting. But disk drives and printers are more mechanical than electronic. They are complex machines with scores of precision moving parts. It is much harder to cut costs because mechanical technology is not advancing nearly as fast as electronic technology.

Second, the well-publicized price war of 1982-83, primarily between Atari, Commodore, and Texas Instruments, forced computer prices to drop even lower. Peripherals were not as affected by the price war partly because many dealers were selling computers "at cost," and then depending upon peripherals and software for profits.

For these reasons it is likely that prices of disk drives and printers will continue to decline only slowly. It is difficult to economize without sacrificing precision and reliability. Cassette recorders, at less than $90, will remain attractive alternatives.

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The greater complexity of disk drives accounts for their other disadvantages as well. Recorders are easier to use, particularly by beginners. They offer fewer features, fewer options. There is no Disk Operating System (DOS) to worry about, and no menu of disk commands to learn. Too, disk drives are sensitive to bumps and jolts when moved from place to place. The read/write head (analogous to the play/record head in a cassette recorder) requires extremely precise alignment for reliable operation. Plus, when a cassette recorder does break down after the warranty period, it can probably be fixed by any good audio equipment repair shop. A disk drive must be fixed at a special service center.

These factors must be balanced against a disk drive's much greater speed, flexibility, capacity, ability to use a wider variety of commercial software, and greater reliability of storage.

To answer your specific question about alternatives to the Atari 810 drive, there are several units now being sold by independent manufacturers. They are regularly advertised in COMPUTE! and other computer magazines. They are not significantly less expensive than Atari drives, but some do offer more storage capacity at a lower price. You should visit your local computer dealer or write the manufacturers for more detailed information. ©

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Millionaire

Gary M. Kaplan

Blue Chip Software isn't making claims about *Millionaire*'s ability to sharpen your stock market investment skill, but it's certainly a vehicle for learning investment finance, and a whole lot of fun. It's available on disk for the Atari 400/800, Commodore 64, Apple II and III, among other computers.

When you first play *Millionaire*, you begin at the Novice level with a $10,000 stake. With it, you can buy and sell 15 different big name stocks in five industry groups. If you like the look of oil and gas, you can own shares in Conoco, Exxon, and Mobil. If you are feeling bullish about the auto industry, General Motors, American Motors, and Bendix are up for grabs. A retail group, a heavy industry group, and (since it's a computer game) a computer group, round out the industries. Purchase decisions are based on a steady stream of business information you'll have to wade through.

Millionaire creates 91 weeks of stock market fluctuations and starts you out at week 14 with access to the preceding weeks' data. From there, you're on your own — either to the good life, or the poorhouse.

Reading The Market

Analysis is the key to your future. And, just like the real market, there's plenty to examine. Each week you'll be given the variables creating the market's present environment. These include corporate histories; a stock market graph showing the overall market trend; industry group graphs showing how each industry is doing; individual stock graphs; stock price tables; and a News Journal with company announcements which may affect business.

A news item might inform you of an IBM technology innovation. That could well mean a rise in IBM stock, but could also affect the entire industry. The value of Control Data and NCR stocks might well tumble.

After you've digested the current state of the market, and determined what is relevant to your potential investments, you're ready to make a transaction. Taking a cue from Wall Street, *Millionaire* is a little cold-hearted to those at the Novice level, where you work on a strict cash basis. If you want to buy stocks, you've got to put up the actual greenbacks.

Upward Mobility

Shrewd maneuvering will propel you to the Investor ($12,000) plateau. Since you're building your fortune, options are opening up. At this level, you can buy on margin (borrow a percentage of the total purchase price of your stocks). Even greater flexibility comes if your fortune increases.

A Speculator ($18,000) is eligible to use *call* options. They assume a significant rise in a stock and allow the buyer to purchase at a slightly higher price at a later date. A Professional ($40,000) may use *put* options. They are used when you predict a significant decline in a stock and allow selling the stock at a slightly lower price. Players at the Broker level ($100,000) can borrow significantly from their net worth.

The road to riches is not smooth by any means. *Millionaire*'s Wall Street is full of traps, and you might fall into any number of them. Your margin accounts may be called, or your capital could erode due to high interest payments and overextended credit. And there are those nasty brokerage commissions and taxes which take a bite out of your purse.

At week 91, your assets are converted to "cash," and a new game can be started at your new financial status. It's a long road before you reach the Millionaire level, but with persistence and a bit of wisdom, it's possible. Wealth — even on Wall Street — usually takes time to accumulate, and *Millionaire* recognizes that financial reality.

Only one person can play at a time, but the names and status of 14 players are retained. (Two or more can play together, providing they come to a consensus on investment decisions.) You can also stop and save the game, picking up where you left off later. Actual game time is approximately two hours.

Millionaire is challenging and provides quite an education in the art, or science, of playing the stock market. It's ideal for beginners because it grounds them in market basics. People with market experience will like it because it's frustratingly true-to-life. For anyone, it's a lot of fun.

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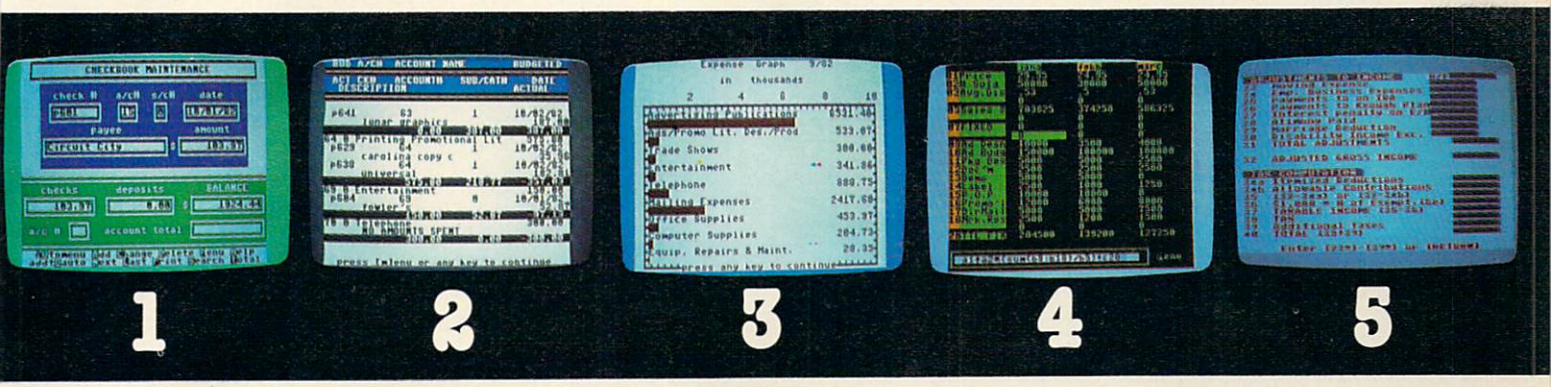

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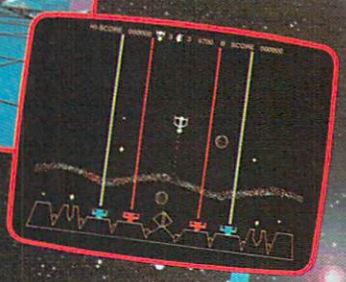

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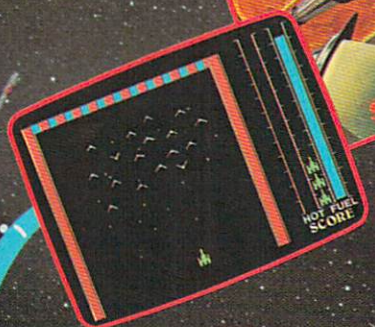

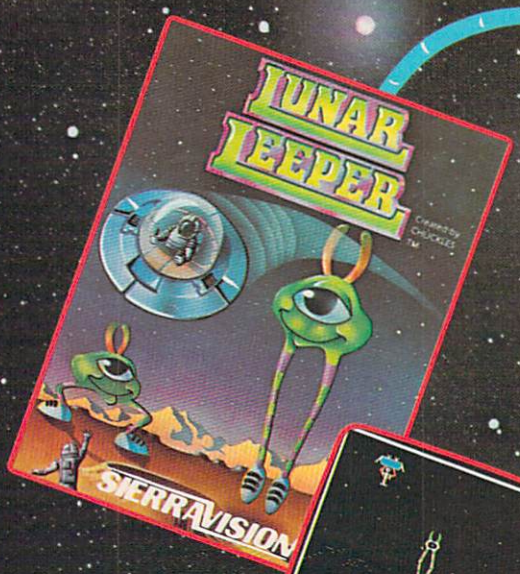

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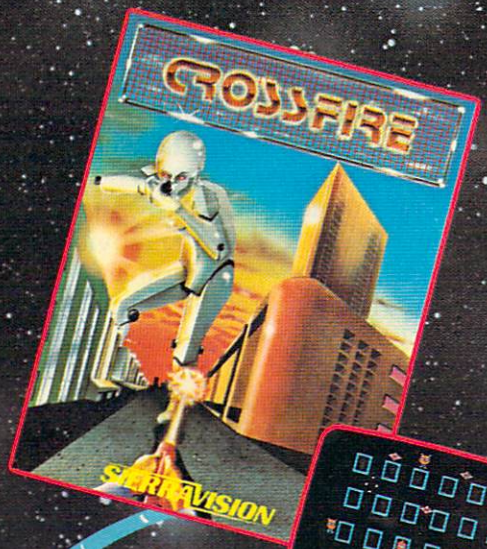

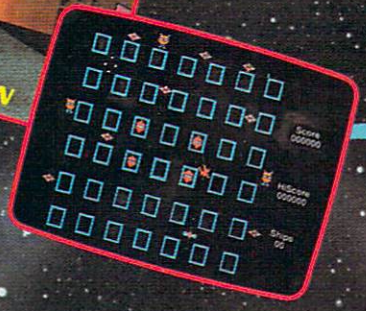

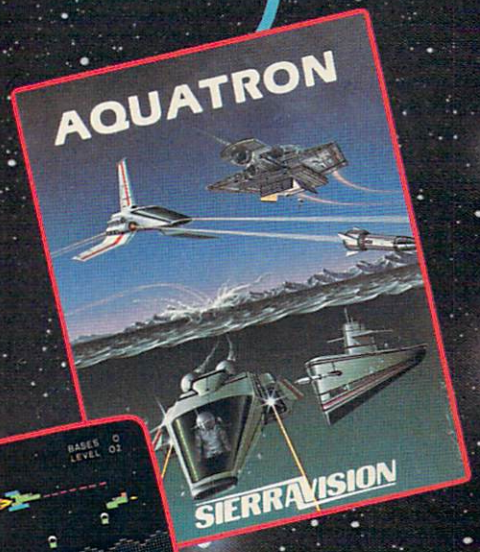

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The Witness

Dan Gutman

Monica *could* have shot her father, Freeman Linder. She had every reason to — her mother had said in her suicide note that she just couldn't take Freeman anymore. Coincidentally, Monica is now the heiress to his fortune, and besides, she left the house only a few minutes before the gunshots shattered the window and Linder died.

Then again, it could have been Phong, the poker-faced butler, who was promised a fortune by Linder — and never got a thin dime. And what about Stiles, Mrs. Linder's secret lover? The poor guy's been in a state since her suicide — or was it murder? He knows Linder ignored his wife, and Stiles was rumored to be a "hired mercenary" in 1907. The case is yours to solve.

The Witness is the latest in Infocom's masterful series of all-text adventures, and it may be their best one yet. The game, available in versions for most microcomputers, takes us back to the Thirties. The writing is colorful, like a pulp detective novel, and reflects the period. At one point Monica tells you this new actor (Bogart) she saw in a movie is not going to make it big. With games like this, the distinction between reading a novel on disk and playing a game has become blurred. *The Witness* is a novel, except that you are one of the characters, and every move you make affects the outcome.

Talking To The Computer

Other adventure games restrict you to simple commands like "go north" and "shoot gun." With Infocom's "Interlogic" programming system, the computer can understand complete sentences. Communicating this way gives you a much stronger sense that you are participating in the story. However, as the game freely admits, "English is my second language." The program will only answer two specific types of questions: ones asking for information and ones asking for the whereabouts of someone or something. You've got to be very careful with your phrasing. If you borrow a note from Monica and type "give back note," the computer will tell you, "You can't see any back note here." You should have typed "give the note back." Nevertheless, with a little cooperation on your part, the computer does a superb job of catching your drift.

If you get hooked on this game (and there's a good chance) you'll find yourself drawing intricate floor plans of the Linder house and jotting down notes to yourself. You will ruthlessly interrogate every suspect and shadow their every move. You will pick up every knick-knack on the mantlepiece and dust them for fingerprints or send them to the lab for examination. You will become frustrated, disgusted, and type rude suggestions into the keyboard. You could start arresting furniture just to see how the computer will respond. You will be possessed.

The Witness is somewhat like *Deadline*, Infocom's first mystery thriller, but *Deadline* tended to bog down as you ran out of leads to follow. Here you are provided with a loyal assistant, Duffy, who is more than happy to make plaster of Paris footprint casts for you, bring objects to the lab for analysis, and uncover little clues you might have overlooked. All you've got to do is "ask Duffy for help."

Infocom does not crank out games and hope that one will click with the public. Each game is so clever and so intricate that you know somebody put thousands of hours of work into it. The game is a piece of art right down to the packaging, for which Infocom has become famous. Out of *The Witness* package tumbles a suicide note, an urgent telegram, a newspaper page containing an article about Mr. Linder, a matchbook with some numbers scrawled on it, and a 12-page *Detective Gazette* with instructions for the game along with 1930s ads for handcuffs and fingerprint kits. And a floppy disk — can't forget that. With this game, you get your money's worth.

For Dedicated Players Only

However, as good as *The Witness* is, it's not a game for everyone. You have 12 hours to solve the crime, but do you have 12 hours to play a computer game? Fortunately, you can save your game on a blank disk and pick it up later. Even so, to investigate every room in the house, question every suspect, and follow up every lead may be equivalent to reading *The Complete Works of Shakespeare*. You can't just stroll around the house by typing "go to Monica's bedroom" or "enter the garage." It may take half an hour of directional search just to find Monica's bedroom, and she may have gone to the movies while you were bumping into the walls. To get in the room, you must first find the key, unlock the door, and open the door — all separate commands. To make matters more difficult, you have no way of knowing if a suspect is telling the truth or lying to you — that suicide note from Mrs. Linder could have easily been faked by Monica, Stiles, Phong, or even Mr. Linder. Infocom supplies no key to solve the mystery, and you may never solve it on your own.

The Witness requires a dedication that few other games require. There are no pretty graphics here. It's you, your imagination, and the words on the screen. My guess is that people who enjoy challenging puzzles — jigsaw, crossword,

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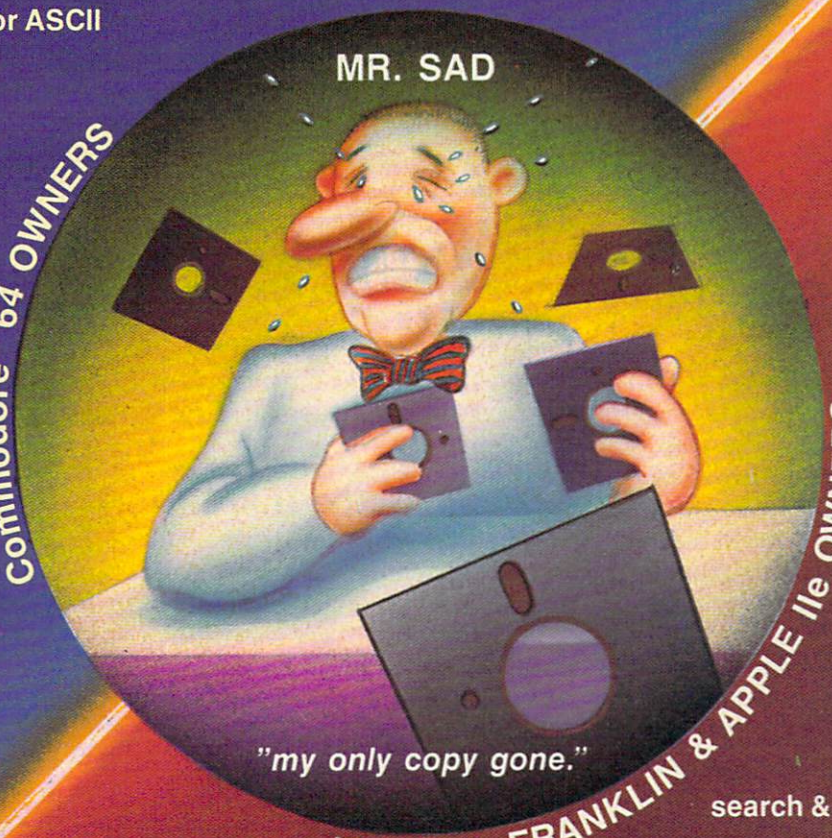

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anagrams — will enjoy *The Witness*, while those who favor television game shows may not. People who like to curl up with a good book — especially a mystery novel — will love it, while those who lean toward *Garfield Goes Condo* should pass it up.

For those of you who choose not to solve the crime, I feel it is only fair to share my findings with you. I have devoted the last three months of my life to this case and just moments ago solved the crime, arrested my suspect, and sent that person to jail. The murderer of Freeman Linder was...

Ed. note: Unfortunately, Mr. Gutman was unable to complete this review for reasons which are still under investigation.

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MAC/65

Craig Chamberlain

Atari's Assembler Editor cartridge is extremely slow. Time spent just waiting for it to assemble a program could be put to much better use programming and debugging, or thinking of new program ideas. For any programmer who spends much time at all using the Atari cartridge assembler, the accumulation of wasted time could be so substantial it might actually be worthwhile for the programmer to rewrite the assembler to make it faster.

Improving The Assembler

Suppose a programmer did decide to improve the Assembler Editor cartridge. For one thing, he would have the editor tokenize each source line, instead of storing it in ATASCII format. This change alone would significantly increase the assembly speed, and would have three bonus side effects as well. First, with a tokenized format it would be possible to LOAD and SAVE source programs just as fast as Atari BASIC can LOAD and SAVE programs; there would no longer be any need to wait for the slower ENTER and LIST commands.

Second, through tokenization, the source file could be compacted to almost half the size of the ATASCII equivalent. The shorter, compacted files would LOAD in even less time, and take up even less disk space. And a condensed program size would make it possible to hold longer files in memory.

Finally, tokenization would allow error detection upon line entry. With the addition of other improvements such as a faster symbol table search, the revised assembler would be extremely fast. If the programmer added some other features like powerful conditional logic, an alphabetized printing of the symbol table, local labels, and macro support, he would have created the best assembler available for the Atari.

A Dream Come True

Stephen Lawrow has made all of these improvements and more, and his MAC/65 macro assembler is the answer to every machine language programmer's dreams. MAC/65 is currently available on the Atari for $80 from OSS, and Apple and Commodore 64 versions are expected soon. This offers users of MAC/65 the added advantage of being able to use the same assembler on three of the most popular personal computers.

Conditional Assembly

Let's take a closer look at two of MAC/65's best features. The first is *conditional assembly* through the use of the directives .IF, .ELSE, and .ENDIF. The .IF directive evaluates an expression and controls how the following code is assembled. If the value is true (nonzero), only the code between the .IF and the .ELSE or .ENDIF is assembled. Should there exist a .ELSE (it is optional), the code between it and the .ENDIF will be assembled if the value is false. It is possible to nest these conditional constructs. One use of conditional assembly is to let the same source listing produce both cassette and disk versions of a program. This feature is even more powerful when used with the operators .DEF and .REF, which tell whether or not a label has been defined or referenced.

Macro Assembly With Numeric And String Parameters

Macros are defined by the directives .MACRO and .ENDM, and consist of a sequence of frequently used source lines that are given a label. Whenever this label appears at any point in the source listing, the corresponding source lines will be inserted into the assembly. It's like a collection of automatic, prewritten subroutines. Here is an example.

```
1000 .MACRO SAVEREGS
     ;save registers on stack
1010 PHA
1020 TXA
1030 PHA
1040 TYA
1050 PHA
1060 .ENDM
.....
.....
.....
5000 SAVEREGS
5010 JSR SOMEPLACE
```

The one call of SAVEREGS in line 5000 will cause five source lines to be assembled in its place. Note, however, that a macro differs in some ways from a subroutine; a macro only affects assembly, and since this example used the stack, SAVEREGS could certainly not be made into a subroutine (which stores a return address on the stack) without a stack conflict.

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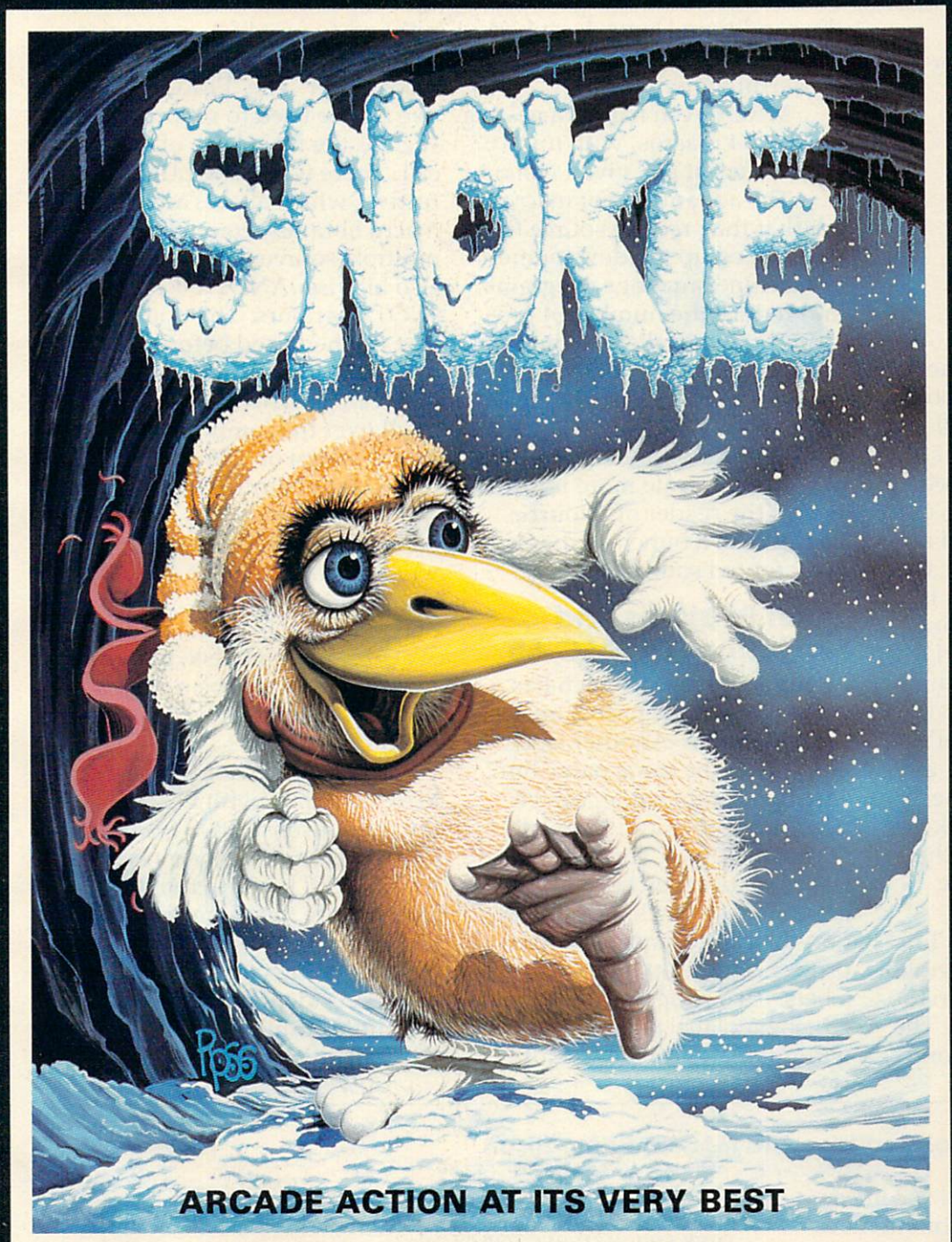
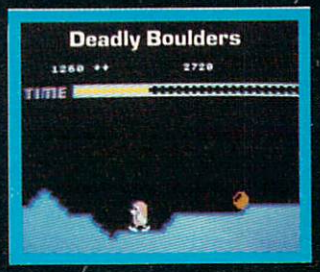
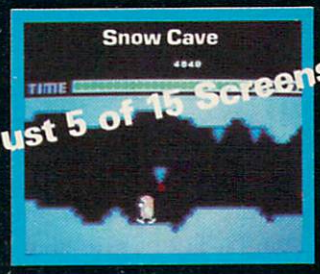
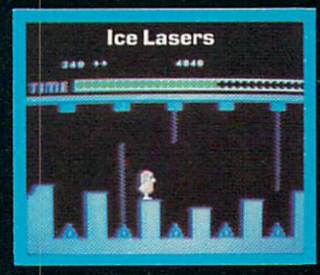






Just 5 of 15 Screens



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A macro can also be defined so that different parameters can be specified each time the macro is called. One good example is the macro defined here to increment a 16-bit memory location.

```
1000 .MACRO INC16
     ;increment a 16-bit number
1010 INC %1
     ;increment lo byte
1020 BNE SKIP
1030 INC %1+1
     ;increment hi byte
1040 SKIP
1050 .ENDM
. . . .
. . . .
. . . .
5000 INC16 $600
```

At assembly time, the value $600 is substituted for the symbol %1, and the assembler will generate the code to increment the 16-bit number at $600. Another good example is the macro definition for OPEN, provided in the MAC/65 manual. Once this macro has been defined, it is possible to have a source line which reads OPEN 3,4,0,"D:FILENAME". This one source line will generate all the code necessary to perform an OPEN operation using channel 3, auxiliary bytes 4 and 0, and the specified filename. This takes a lot of the drudgery out of the tasks of writing in machine language.

In the definition of OPEN (not reprinted here), the symbol %1 would represent the first parameter, in this case a 3. The second parameter corresponds to %2, and so on. String parameters are indicated using a dollar sign, as in %$1. The symbol %0 is reserved to tell how many parameters were included in a macro call. Combine this with the conditional logic described earlier and you have some very powerful tools.

MAC/65 can handle a nesting level of 14 macros, with up to 63 parameters at any given instant.

The advantages of macros are that they reduce source file size, speed up the development of machine language programs, and reduce the number of programming mistakes. Typing the same code several times increases the risk of error, but a macro is defined only once. Also, a carefully chosen macro name can communicate more information to the reader of a source listing than a bunch of sparsely commented source lines.

Other Features And Limitations Of MAC/65

A local label is one which has a value in only one part of an assembly source. Another label, possibly of the same name but with a different value, can be used in another local section without conflict. This is especially useful when several programmers are each writing sections of a large machine language project. Through the use of local labels, each programmer can use whichever label names he wants, without fear of causing "duplicate label" errors by using label names already chosen by the other programmers. Local labels are possible in MAC/65 with the .LOCAL directive.

The directive .BYTE will print up to four byte values per assembly line, which can save a lot of paper. The .ERROR directive can be used to report errors, such as the illegal use of a macro call. There is an .INCLUDE directive, which allows access to macro libraries, equate files, and multiple source files. There are also bitwise .AND, .OR, and .NOT operators. The operators > and <, when used before an expression, return high and low byte values. This is an improvement over the common, but error prone, usage of /256 and &255.

The RENumber, FIND and REPlace commands of the editor are usually satisfactory, but it would be nice to have a MOVE command. MAC/65 will work only on a 48K machine and is available only on disk, but these two problems will be solved if OSS releases MAC/65 on a cartridge.

It should be noted that MAC/65 comes with OS/A+, the no-nonsense DOS from OSS. OS/A+ is completely compatible with DOS II because the disk routines are the same, but the DUP portion of DOS II has been replaced with a monitor that is always resident and takes up very little additional memory. You can quickly read a disk di-

Atari Assembler Editor Cartridge And MAC/65 Comparison

The test file contained 962 lines of nicely formatted, commented code, and made extensive use of labels but no macros. Macros will slow down MAC/65. The object file was about 2500 bytes. All assembly times are with listing turned off. EASMD is OSS's disk version of Atari's ASM/ED, and is nearly identical to the cartridge.

	EASMD	MAC/65
DISK FILE SIZE (SECTORS)		
(ENTER FORMAT)	231	
(LOAD FORMAT)		133
FREEMEM (BYTES)	30207	28031
TIME TO ENTER (SECONDS)	96	82
TIME TO LOAD	–	0:15
FREEMEM WITH PROGRAM	02389	11489
ASM MEMORY TO MEMORY	323	less than 5 seconds
ASM DISK TO DISK	444	50

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rectory or unlock a file without erasing your program, and there is no need for the questionable MEM.SAV file.

Speed

MAC/65 is amazingly fast. For relatively small programs, no sooner do you type ASM and press the RETURN key than the assembler starts printing the second pass.

The incredible speed of this MAC/65 has greatly increased my productivity as a programmer, not just because it assembles programs faster, but also because while waiting for the old cartridge, I would often switch the television channel and become interested in a show. Now with MAC/65 there's no time to get distracted.

MAC/65 can assemble source files so fast (for memory to memory with no listing, it takes just a few seconds at the most) that the actual assembly speed becomes almost irrelevant. When assembling from disk, the only thing holding MAC/65 back is the slowness of the disk drive. For a comparison between the Atari cartridge and MAC/65, see the chart.

The Apple version of MAC/65 assembles from disk to disk at twice the speed of the Atari, due to the faster speed of the Apple disk drive.

Reference Manual

MAC/65 comes with a reference manual which gives complete descriptions of all commands, operators, directives, and errors. It is not a tutorial and does not teach machine language. A small macro library is also provided to get the user started. The manual could stand improvement, but it is a good manual, covers all necessary topics, and contains examples.

Compatibility With The Atari Assembler Editor Cartridge

Here is a list of all the differences between MAC/65 and the Atari cartridge.

1. Source files are completely upward compatible with one exception. MAC/65 uses an algebraic operating system with different precedences for different operators (like BASIC), while the cartridge performs all operations from left to right. Expressions like LABEL+2/256 will have to be rewritten using brackets, such as [LABEL+2]/256.

2. MAC/65 has a TEXT mode which turns off the error checking upon line entry, so the editor can still be used to do things like renumbering Atari BASIC programs.

3. There is no DEBUG mode. Only the commands C and D (change and display memory) have been kept. All the other debugging features, including memory manipulation, breakpoints, the instant assembler and the disassembler, are available in BUG/65, an interactive debugging tool which comes with MAC/65.

4. The .INCLUDE files must be in SAVE format.

5. The directive .PAGE now prints at the bottom of a page, not at the top.

6. Bulk line deleting is faster.

7. FIND and REPlace are slower, because the source is not stored in straight ATASCII.

8. Although MAC/65 still does not print a total error count at the end of an assembly, it does at least list all errors to the screen, even if the output is directed to another device such as the printer.

9. Automatic page numbering.

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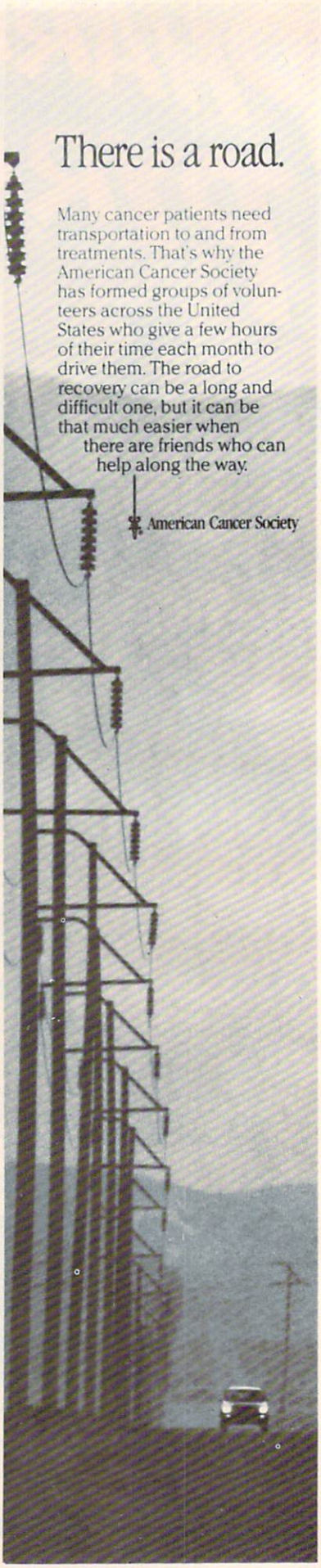

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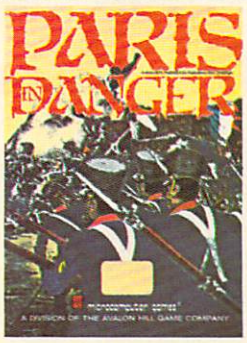

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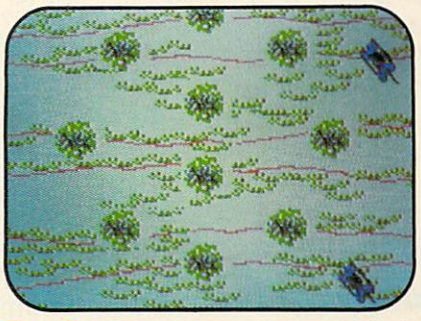

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Stellar Triumph

Eric Brandon

Space games have nearly become clichés in the world of videogames, but *Stellar Triumph* from H.A.L. Labs is a fun and unique addition to any Commodore 64 game library.

Stellar Triumph pits two players against each other in mortal combat. Each player is given a spaceship, fuel, and up to 32 shots. You can rotate your ship, or thrust either forward or backward with your engines. The objective is simple: Beat your opponent before he beats you.

Playing By Your Own Rules

What makes the game so interesting is the control you have over the "rules" that govern combat. Using simple menus, you can define an incredible number of variables resulting in great variety.

Your ship can either have "inertia," which causes it to drift when you're not thrusting, or it remains stationary until you move it. You can also define the strength of the thrust, and how much fuel you have. Your shots can be fast or slow, and they can be fired in rapid bursts or one at a time.

The best feature, however, is that you can define the properties of the universe you play in too. For example, the gravity of the sun can be either weak or strong, positive or negative (pulling you in, or pushing you away), or there can be no gravity at all. Just to keep things interesting, you can include asteroids to crash into, aliens which shoot at you, and the "mysterious monoliths" that sometimes bounce your shots.

The game is fascinating to watch when you select high gravity. Objects can go into orbit around the sun, and you can use the gravity to speed yourself up as you go around the sun.

Many people do not have two joysticks since so few games allow two players. In *Stellar Triumph*, either or both players can control their ship from the keyboard.

Because you have so much control, your $25 buys you much more than one game. By setting the parameters correctly, you could have a tank battle, an airplane dogfight, or, of course, any number of space battles. If you don't feel like defining the universe, you can always play one of the eight predefined games available, simply by pressing the function keys.

Overall, *Stellar Triumph* is an exceptionally enjoyable game to play, and it offers you the chance to play a human opponent rather than the computer.

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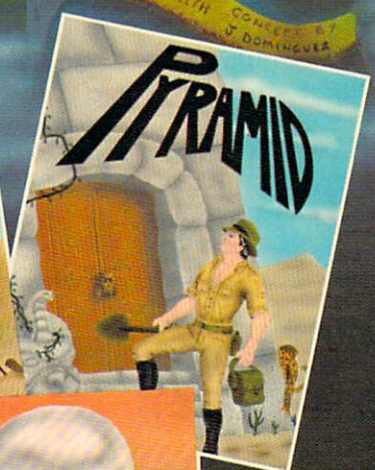

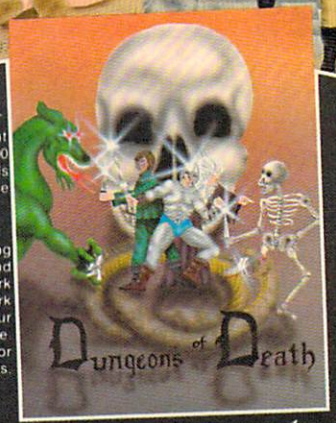

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Gamestape 1 For The Timex/Sinclair

Arthur B. Hunkins

Melbourne House produces remarkably high quality software for the Timex/Sinclair. In this review, we'll look at an excellent package, *Gamestape 1*, which contains 11 games for the 1/2K Timex/Sinclair. All programs run in 1K, and – what is really remarkable – all but one are in BASIC. (Thus, ten of the eleven are listable, and serve as an excellent source of ideas for economical, imaginative, simple game and graphics programming.)

Educators will particularly enjoy their use of PEEK, INKEY$, CODE, SCROLL, PRINT AT, RND, AND, and OR. (This tape is worth purchasing as a tutorial alone.) Nonetheless, the primary purpose is fun, and fun there is. I will evaluate the games on a scale of one to ten, with ten being high. Parenthetically, it is a real joy to play games that don't take over five minutes to load and then freeze up. Also, the tape exhibits no LOAD problems.

Klingons – 9. Ram as many of the oncoming fleet of 200 Klingons as you can. Pay particular attention to the high-score motherships. Good for hand-eye coordination. Self-competitive scoring.

Crash Landing – 5. A Lunar Lander without graphics – cockpit readout only. Requires patience and time. Program bombs with error message if you crash.

Simon – 6. Flashing sequences of four colors (names) that must be repeated by responding with first letters (within 30 seconds).

Artist – 8. Simple, quarter-square drawing program that can dump the screen to a printer. Positioning is by cursor control arrows and quarter-square diagonals. All keys repeat, and you can erase as well as draw, reposition, or clear screen.

UFO – 7. Fire at stationary aliens from a moving spaceship. 100 points possible; penalties for going off the screen and missing. Spaceship goes faster as game progresses. Good for hand-eye coordination.

Code – 9. Version of *Mastermind* – guess a four-digit number in ten tries (number of tries can easily be changed in program). Each digit is different, and program cannot handle responses that contain repeat digits. Challenging.

Asteroids – 3. Dodge asteroids by maneuvering right or left; continues until you crash. Self-competitive scoring. Simple and somewhat boring, except for youngsters developing hand-eye coordination. Autorun.

Bomber – 6. Bomb ten dams. Runs shorten as your aim gets better. Highly repetitive, but represents a more complex hand-eye coordination challenge.

Kaleidoscope – 5. Typical symmetrical quarter-square graphics in center of screen. Interest limited by quarter-square graphics. Program demonstrates effective use of PLOT and UNPLOT (erase) to achieve pattern. Autorun.

Guillotine – 10. Version of Hangman. You get ten wrong guesses as the guillotine is built; at the tenth wrong guess, your head gets chopped off. This is the only two-player game; one player has to furnish the word. When a correct letter is guessed, all occurrences of it are filled in. The program accepts words as long as antidisestablishmentarianism. Simple yet effective graphics.

Breakout – 10. This is *the real winner*, and the only program in machine language. Most programs on the Timex/Sinclair are turtle-slow – *not this one*. Three speeds and two bat sizes may be selected. I challenge any *Breakout* pro to achieve a respectable score at the most difficult level. About half of the time my score was zero. It's a major challenge just to get in position to hit the first ball. On the other hand, at the lowest level, any beginner should be able to compile a respectable score.

Gamestape 1 includes an insert which gives adequate instructions. With only 1K, expect simple, functional (and in BASIC, slow) graphics – nothing fancy. This package is a real bargain at $14.95.

Gamestape 1
Melbourne House Software, Inc.
333 E. 46th St.
New York, NY 10017
$14.95

©

Memory Expanders For The VIC-20

Ottis Cowper, Technical Editor

Creative users have developed programs of surprising sophistication for the unexpanded VIC. However, some programmers have felt that working within the 3583 bytes left after BASIC grabs its share of the 5K of built-in memory puts unacceptable constraints on their creativity. As a result, memory expanders for the VIC began to appear very soon after the computer itself hit the shelves.

The simplest form of memory expansion is the RAM cartridge, which plugs into the memory expansion port on the back of the VIC. They usually expand memory in multiples of 8K, although the first VIC mem-

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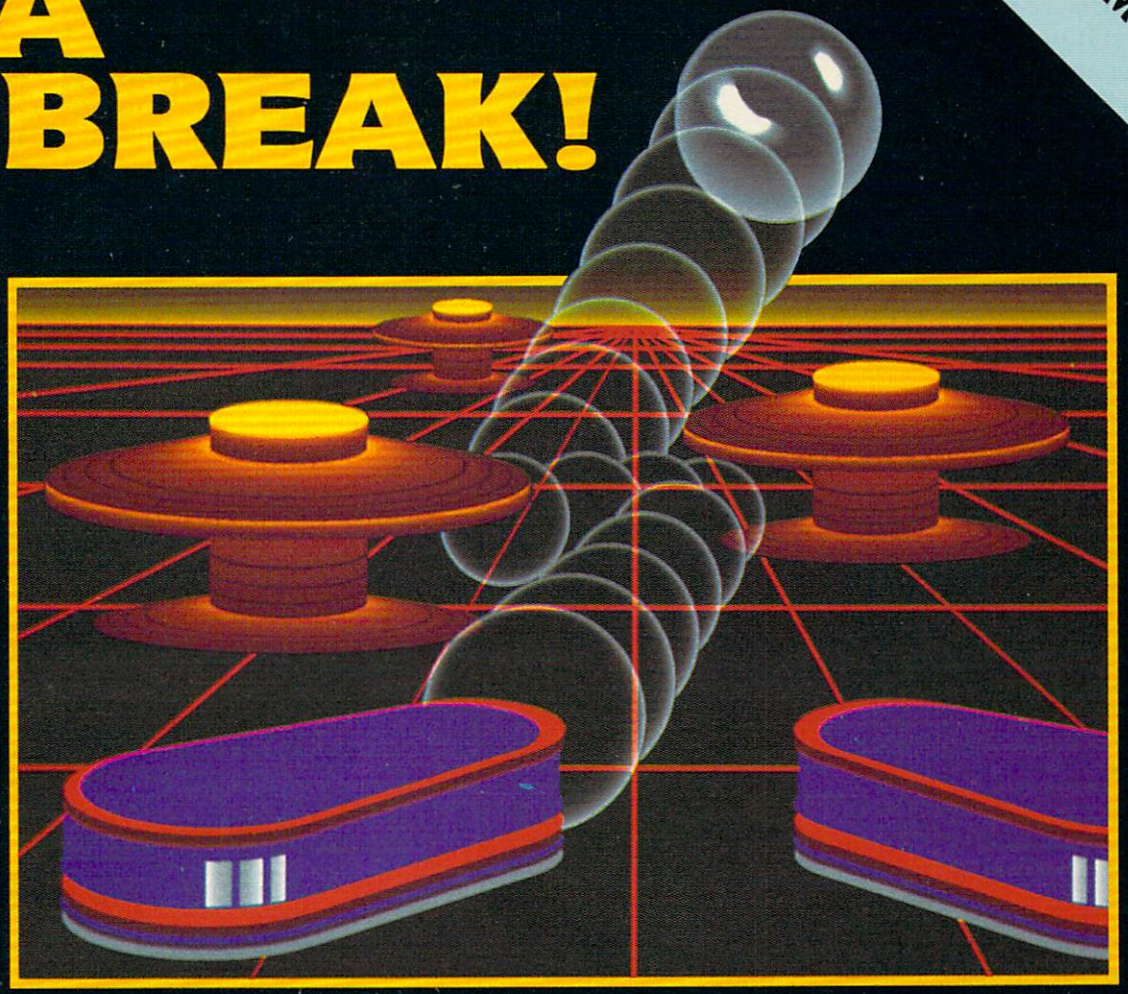

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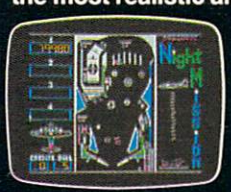

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ory cartridges added only 3K. Some of these are still in circulation. The great advantage of the cartridges is their simplicity — just plug them in. The main disadvantage is a certain lack of flexibility: It is necessary to remove the memory cartridge to plug anything else into the expansion port — a game cartridge or the Super Expander, for example. This can be overcome by using a *motherboard*, a device which plugs into the memory expansion port and acts like a multioutlet extension cord for the port, and there are as many different motherboards available as there are RAM expansion cartridges. A second disadvantage is that it is not as easy to change the address range of the added memory when using cartridges as it is with some of the more complex expansion systems. This, however, really should not present a problem for most users.

Commodore RAM Cartridges

Commodore makes two expansion cartridges for the VIC: the VIC-1110, which provides 8K expansion, and the VIC-1111, which provides 16K expansion. An added feature of the 8K cartridge is that it can be set to one of four address ranges, and, if you have a motherboard, can be used in conjunction with the 16K cartridge to provide 24K expansion, the maximum amount VIC BASIC can use without special programming.

RAMAX By Apropos

RAMAX, made by Apropos Technology of Camarillo, California, is something of a fusion of a RAM cartridge to a motherboard. It provides 27K of expansion RAM and two additional cartridge slots. A DIP switch allows you to selectively activate 24K of the additional RAM in three 8K blocks. The additional 3K block, if activated, goes to fill a hole in the unexpanded VIC's RAM space between locations 1024 – 4095 where no built-in memory is installed. This is the same 3K block filled by the additional RAM in the Super Expander cartridge, and by the 3K plug-in cartridges. The 3K block can be added alone or in conjunction with any of the other 8K blocks. However, BASIC cannot use the 3K block along with the 8K blocks without special programming. With the 8K blocks activated, the 3K block can be used to hold redefined characters and machine language subroutines.

Various memory expanders are available for the VIC.

If a block of memory containing data is switched out, the data is still maintained until the computer is turned off. If the memory block is switched back in, the data can be accessed as before.

The two expansion slots can be used for game cartridges or for utility packages like VICMON or the Super Expander. However, the slots are not switched, so you must avoid inserting two cartridges which use the same address at the same time. There is a DIP switch on the RAMAX which disables memory in the range 40960 – 49151, the area used by most cartridge game ROMs. This provides a way to effectively switch on and off a game cartridge plugged into one of the slots.

There is one additional DIP switch on the RAMAX which provides a valuable feature: the *warm start reset* switch. If you've ever experienced a "lock up" resulting from a bug in a machine language program, you've probably wished for something that would allow you to regain control of your computer without having to turn it off. That's what the reset switch does.

The RAMAX draws its power from the VIC, but adds a 0.5 amp fuse to protect the computer from any short circuits on the board. This proved to be a valuable safety feature. On several occasions programmers here at COMPUTE! failed to heed Apropos' warning that cartridges should not be installed or removed from the RAMAX while the power was turned on. This resulted in blown fuses on the RAMAX. And without the fuse the VIC itself might have been damaged.

The RAMAX comes with a ten-day money-back guarantee and a six-month warranty on parts and labor. An extended service contract is also available. We were most impressed with Apropos' customer service. Shortly after we received our first RAMAX, Apropos detected a possible defect in the RAMAX and recalled for modification all boards that had been shipped. We had our new RAMAX back in a matter of days.

The RAMAX also comes with a very complete brochure explaining all the available memory configuration options.

Golden RAM By Voice World

The Golden RAM Expansion Chassis made by Voice World of Del Mar, California, offers exceptional flexibility in configuring the expansion memory. The Golden RAM has 24K of memory in three 8K blocks. Each block can be installed at one of two starting addresses. One of the blocks can be switched to start at location 40960 ($A000), which is a special block in the VIC. Programs starting there, and beginning with the proper character sequence, will run automatically after a system reset. This is how

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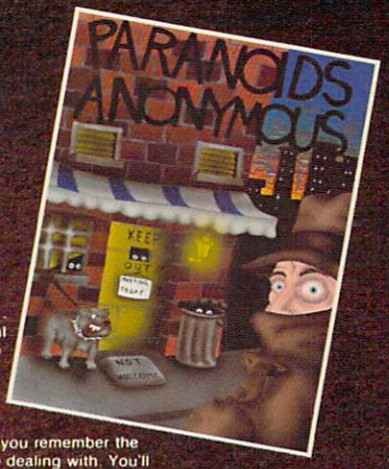

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cartridge games are made to start when the computer is turned on. As with the RAMAX, data is not lost when the blocks are switched in and out. Also, two of the 8K blocks of RAM can be switched to a *read only* mode in which they emulate ROM and cannot be overwritten (although all data is still lost when the power is turned off). These special features could be very valuable to those involved in serious program development, although the casual user may never find a need for all of them.

The Golden RAM includes four cartridge expansion slots. An excellent feature of this expander is that the four slots can be switched in and out. It is possible, for example, to leave your four favorite game cartridges plugged into your VIC at all times and simply switch in the one you wish to play. This ends the need to constantly plug and unplug cartridges. The Golden RAM also has a reset switch, a large push button which is a significant improvement over the tiny DIP switch for reset on the RAMAX.

As with the RAMAX, the Golden RAM draws its power from the VIC. It is equipped with a 0.5 amp fuse to protect the VIC from short circuits. A spare fuse is also supplied.

The Golden RAM comes with a full one-year warranty.

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TI Statistics

Roger B. Crampton

In many professions there is a need to analyze something statistically. Engineers, medical researchers, psychologists, and social scientists often must generalize from data samples and make predictions concerning the probability of events. Not many years ago this data analysis was a tedious and expensive task, using calculators and many clerical assistants to perform manual computations.

In addition, because the mathematics of statistics appear so formidable, professionals often hesitate to try to explain the implications of their data.

Texas Instruments has helped remove some of this anxiety with its *Statistics* Command Module, a series of programs that perform dozens of the most commonly needed statistical techniques.

The module leads the researcher through the procedures of statistical analysis in a friendly and efficient way. The only hardware requirements for running complicated statistics programs are the TI-99/4 or 4A console, a monitor, and the module. While not essential, a printer and a cassette or disk drive will eliminate having to reenter the data set and file structure if you want a second look at your findings.

Learn The Basics First

Before plugging in the module, it is important that you thoroughly read the 48-page instruction manual at least twice. The time spent will be rewarded with a clear understanding of the module's capabilities and a basic understanding of statistics itself.

When the module is inserted into the console, a title screen is displayed, followed in a few seconds by the first of several menus (see Figure 1).

Figure 1: Program Options

```
PRESS
 1  TO CREATE A NEW FILE
 2    LOAD AN EXISTING FILE
 3    USE SIGNIFICANCE LEVEL
       CALCULATOR
 4    QUIT
```

Typing 1 allows you to set up your file structure. You name each variable, determine its type (alphanumeric, integer, decimal, or scientific notation), and enter the maximum number of digits of each variable. The number of variables allowed depends on the width of each entry and the number of observations. Conversely, the number of observations that you will be able to enter depends on the number and specifications of the variables you have selected. It is important to carefully define the parameters of the problem so that you will be able to use all of your observations without getting a MEMORY FULL message.

Another reason for care when you specify the initial file structure is that there are no provisions for editing file specifications once they have been set up.

When the file structure has been established, the next menu will be displayed (see Figure 2).

Figure 2: Basic File Structure

```
          MAIN INDEX
PRESS
 1  TO SEE FILE DEFINITION
 2    ENTER OBSERVATIONS
 3    CHANGE OBSERVATIONS
 4    ANALYZE DATA FILE
 5    SAVE DATA FILE
 6    QUIT
```

At any time, you can return to the main index, select option 1, and review the specifications of the file. But remember, you don't have a chance to change anything, unless you're willing to reenter the entire file definition.

Entering Data

When you are certain that your file is arranged exactly as you

want it, it's time to select option 2 and begin entering data. The module will prompt you with the names of the variables as each is typed in.

Data entry is slow. A fast typist must slow down to about half speed because the module will not accept entries at usual typing speed. The first variable value will be accepted, but the initial digit of the second or succeeding variables often gets lost. An entry of 84 becomes 4, an entry of 1.3794 will become .3794.

After all your data has been entered, you can verify its accuracy by selecting option 3 from the menu and single-stepping through your data set, making any changes that are necessary. There is no provision for LISTing your data to a printer to check each observation for accuracy. This would be desirable, especially to see that decimal data is properly entered.

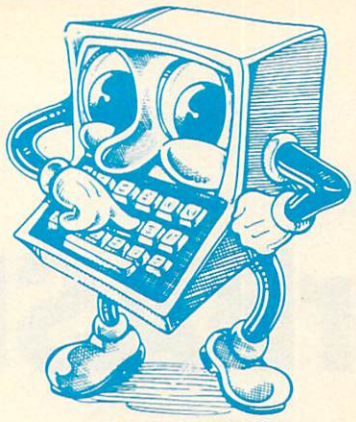
Analyzing The Data

At last the preliminaries are completed, and you're ready to get down to the real purpose of the program: looking at your data from a statistical point of view. By pressing option 4 of the main index you are given a new menu (see Figure 3).

Figure 3: Analysis Options

```
ANALYZE DATA FILE
PRESS
 1  FOR DESCRIPTIVE
      STATISTICS
 2    CORRELATION
 3    LINEAR REGRESSION
      ANALYSIS
 4    INFERENTIAL STATISTICS
 5  TO EXIT THIS SECTION
```

Each of the four options is thoroughly described in the user's manual. Few researchers will need all of the procedures available. In fact, it may be best to learn to use one technique at a time. The enormous amount of information from the analysis of even a simple data set can be overwhelming.



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Although the *Statistics* Command Module can provide volumes of information about a data set, it does have limitations. Evaluation of a great deal of information can be hampered by memory problems if the module is used without memory expansion. In addition, no provision exists in the program to screen out data entry errors by specifying acceptable ranges for each variable.

For nonprogrammers who need a means of analyzing fairly simple data sets, however, the module can be a useful tool. And for anyone seeking a relatively painless introduction to statistics, it is superb.

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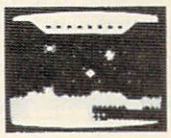

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SuperBASIC 64

Martin C. Kees

How would you like to be able to access 37 valuable new commands when you're programming on your 64? SuperBASIC adds sprite, color, graphics, sound, and memory management features and also enhances eight of BASIC's own commands. And it's designed to work as easily and as quickly as any ordinary BASIC instruction. Typing it into your computer is foolproof; you won't be allowed to go on to the next line if you make a typing error. (See the instructions for using the MLX entry method, on page 216.) Once you try it, you'll wonder how you programmed without SuperBASIC — it's an especially valuable addition to any 64 owner's library of programs. As a bonus, there's also a PET emulator and several demonstration programs so you can see SuperBASIC in action.

SuperBASIC adds commands to BASIC using a special technique. BASIC is automatically copied to its matching RAM and modified to change the STOP command to a wedge vector (similar to Apple's ampersand (&) wedge). The character chosen was the left bracket ([). Then, using four-letter mnemonics following the wedge character, you can select what you want SuperBASIC to do.

These machine language routines make it very easy to control virtually all the VIC-II chip special features. Sprites and hi-res graphics can be controlled from BASIC without having to POKE or use Boolean functions to enable special graphics modes. Since BASIC was moved to RAM to implement the [wedge, this made it convenient to enhance a few BASIC commands. I added the use of variable expressions for GOTO and GOSUB, and RESTORE by line number. These changes to BASIC in RAM don't slow execution as they would have if CHRGET wedging techniques had been used.

SuperBASIC Command Format

The commands can be used in both direct or program mode. The general format is [xxxx ‹exp›,‹exp› where xxxx represents the four-character mnemonic and ‹exp› is a number, variable, or a valid BASIC expression. When a color is selected, use the standard value ordinarily POKEd to the VIC chip. I have used the same coordinate system for sprite positions as given in Commodore documentation. The hi-res upper-left corner is 0,0, and the lower-right is 319,199. Commands that switch a function on or off use 0 for off and 1 for on.

SuperBASIC includes two types of changes to normal BASIC, enhanced commands and new commands. Enhanced commands include GOTO and GOSUB and variants with IF and ON. You can use a line number expression for these commands. This can help in program readability, allowing constructions such as GOTO KEY where KEY = 1000. This would transfer control to line 1000. RESTORE can also be followed by a line number expression. RESTORE KEY would cause the next READ to use the first DATA statement encountered at or after line 1000. This allows DATA statements to be selected under program control. Small files could be maintained in DATA statements and accessed by line number. When LISTing a program, the SHIFT key pauses the list until released. The ASC function will return a value of zero for null strings.

The new commands can be divided into five categories: sprite, sound, color control, VIC memory mapping, and graphics control. A convenience command [CATA is also included. This lists to the screen all mnemonics defined in SuperBASIC.

Loading The Program

To type in SuperBASIC 64 (Program 1), you *must*

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Characters per field	up to 254
Fields per record (max.)	20 recommended (more allowed)
Records per file	to disk capacity
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Nested subtotals	to 5 deep

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use the "MLX Machine Language Editor" program presented elsewhere in this issue. Be sure that you read the MLX article and understand how to use MLX before attempting to enter SuperBASIC.

The numbers you type in create a low memory loader for SuperBASIC which can be LOADed and RUN as if it were a BASIC program. Because the data for the SuperBASIC loader must go into the same area of memory where BASIC normally resides, a special tactic must be used to prevent the SuperBASIC data from overwriting MLX as it is entered. First, turn the computer off and back on to reset memory pointers to their normal values. Next, type in the following line in direct mode (without a line number) and hit RETURN:

```
POKE 44,22: POKE 642,22: POKE 5632,0: NEW
```

This moves up the start of the memory area used by BASIC so that all of the data for SuperBASIC will fit below MLX without interference. Now LOAD and RUN the MLX program in the normal manner. When MLX asks for the starting and ending addresses for SuperBASIC, give 2049 as the start and 5264 for the end. When you finish typing in the data for SuperBASIC, use the MLX Save command to store a copy of the SuperBASIC loader on disk or tape. If you do not type in all the data for SuperBASIC in one session, you must repeat the procedure for moving up the start of BASIC before loading MLX to complete your entry.

When you have a complete copy of the loader, you must reset memory to its normal conditions before LOADing and RUNning SuperBASIC. You can do this by turning the computer off and back on, or with the command SYS 64738. When you RUN the SuperBASIC loader, it first copies BASIC from ROM into the underlying RAM and makes modifications to certain commands. Then it copies the machine language for the rest of the SuperBASIC routines into memory at $C000 – $CC00. No other machine language subroutines which use memory starting at $C000 can be used with SuperBASIC 64, but the DOS Wedge program can be used without conflict. The loader erases itself from the BASIC memory area after it is RUN.

The SuperBASIC commands will be enabled until you hit RUN/STOP-RESTORE or POKE 1,55. Once loaded, SuperBASIC can be reenabled with POKE 1,54. The programs you write with SuperBASIC commands are loaded and saved in the normal manner. The only conflict with normal BASIC is the use of the STOP command. It is not available; use END instead. When SuperBASIC commands are listed while SuperBASIC is disabled, the [character will print as STOP.

Sprite Commands

[DSPR [MOVE [KSPR [ESPR [BSPP

These commands are used in defining sprite characteristics and controlling sprite movement. [DSPR (Define Sprite) is a general setup command that initializes a sprite for the VIC-II chip. The ten arguments in the parameter (see SuperBASIC commands at the end of the article) specify most of the options available for sprite control. [DSPR enables the selected sprite (numbered 0 – 7), stores block (blk) address in current screen pointer table, expands if xexp or yexp = 1, determines initial display position (xpos,ypos), and sets sprite color registers. Multicolored sprites are selected by setting multi = 1, single color by multi = 0. Mc0 and mc1 are optional arguments in the list which set up multicolor 0 and 1. [MOVE moves the selected sprite to xpos,ypos. Horizontal values greater than 255 are handled automatically. [KSPR and [ESPR kill or enable the selected sprite. [BSPP sets background/sprite priority for the selected sprite (sel = 1 sets background in front of sprite).

Sound Commands

[SSND [PLAY

These commands access some of the features of the SID chip. [SSND (Set up sound) produces a sound from one of the three voices of the SID chip. Voice (1 – 3) selects the voice, ad and sr control the attack/decay and sustain/release registers of the selected voice. Wave controls the waveform, gating, and special effects functions of the sound chip. Wave, ad, and sr use the same values that would normally be POKEd to these registers. Freq controls the frequency of the voice but is a 16-bit value in the range 0 – 65535. Pwidth is the pulsewidth value for the pulse waveform and is needed only when wave = 65. Pwidth is an 11-bit value in the range 0 – 12228. [SSND sets the volume register to 15. [PLAY is a short form of [SSND that assumes AD/SR values have been set previously. Waveform and voice values are coded into the first parameter argument by wave*256 + voice. Freq and pwidth are used the same as in [SSND.

VIC Color Control

[BKGD [BKG4 [EXTC [FCOL

These commands control background, border, and text character color. [BKGD sets the background to the selected color. [EXTC sets the exterior border color to the selected color. [BKG4 sets all four background color registers (used in extended color and multicolor bitmap modes). [FCOL (fill color memory) fills the color memory block with the selected color. This causes all text on the current screen to be displayed in the selected color. [FCOL is also useful in multicolor bitmap mode to set multicolor pixels.

VIC Memory Mapping

[BANK [VS1K [CB2K

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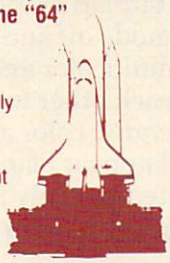

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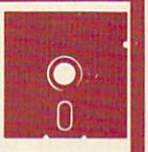

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The VIC chip views memory differently than does the 6510 chip. VIC sees only 16K at a time and maps the ROM character set into part of this 16K bank at times. These commands allow changes to the normal locations of the screen and character sets. [BANK selects which one of four banks (0 – 3) the VIC chip sees. Normally this is bank 0. [BANK resets the pointer BASIC uses to locate the screen. [VS1K determines which 1K block of the 16 available is used for the text screen. The blocks are numbered 0 – 15. The BASIC screen pointer is reset for this location. [CB2K controls which 2K block of the 8 available is used for the character set. In banks 0 and 2 the ROM set is located at 2K blocks two and three. [CB2K is also used to select which 8K block is used for the bitmap screen, values 0 – 3 select the lower 8K block, and values 4 – 7 select the upper 8K block. These three commands must be used in coordination to smoothly relocate the screen. Caution must be exercised in selecting locations since a system crash will result if the screen overwrites important RAM such as page zero. Banks 2 and 3 must be used with great care. (More on bank 3 usage later.) Program 6 demonstrates relocation to PET standard locations for the screen and BASIC.

Graphics/Text Control

[ECGR [MCGR [BMGR

These commands select extended color, multicolor, or bitmap graphics modes. A value of 0 turns the mode off and a value of 1 turns the mode on. Only multicolor and bitmap work in conjunction with each other to form a combined mode. When extended color and bitmap are both on, the screen will appear blank. This effect might be useful for temporarily hiding the screen.

[MXGR [KMXG [CMXV

These commands set up a simple interrupt routine that allows mixed modes to appear in two sections of the screen. [MXGR will change the contents of one VIC register (reg) or part of its contents (the bits OFF in mask) each time the raster counter register equals one of the two raster select values (rast1 and rast2). The values in val1 or val2 will be stored into the selected VIC register. You must determine the appropriate value for the particular register. For example, [MXGR 33,240, 152,6,252,1 will cause screen lines 51 to 151 to be displayed with background white and lines 152 to 251 with background blue.

The visible portion of the screen extends from raster 51 to raster 251. [KMXG will kill the interrupt and leave the selected register in an unknown state. [CMXV (change mixed-mode values) allows changing val1 and val2 while mixed mode is in force. By setting them equal, a known state will be in effect after [KMXG. The interrupt routines are simple in that normal IRQ still occurs (keyboard scan, clock update, etc.) so that the transition will tend to creep. To keep the change precise, you must disable interrupts from the CIA. This will kill the keyboard, however, so I/O would be limited to joystick ports only.

[SIZE [XYSC

These commands help use the smooth scroll registers of the VIC chip. [SIZE selects 40 or 38 columns for the text display chosen by setting colsel to 1 or 0 (colsel = 1 selects 40 columns) and sets number of lines to 25 or 24 (rowsel = 1 selects 25 lines). [XYSC moves the entire text screen up to seven pixels horizontally or vertically. By setting xpos and ypos to a value in the range 0 – 7, the screen can be stepped a pixel at a time to produce a smooth scroll. When used in conjunction with a machine language scroll routine or the automatic scroll up, text can be scrolled smoothly across or up the entire screen.

[DLCS

[DLCS (download character set) assists in using banks without ROM character set images and in designing custom character sets. You can copy the uppercase graphics set, upper- and lowercase set, or both by setting set equal to 0, 1, or 2 respectively. This is followed by the address of the first location in memory where you wish the ROM set to be positioned. This should be on a 2K boundary unless you wish to change the order of the set. When the address is 53248, the set will be copied into the RAM beneath the ROM set for use in bank 3.

[FBMS [FSCR

The current hi-res screen (determined by the last [CB2K command) can be filled with any byte value with [FBMS (fill bitmap screen). [FBMS 0 would clear the entire 8K screen. [FSCR works in a similar way with the current text screen. The entire screen is filled with a byte value. Since the text screen is used for color control in hi-res mode, [FSCR can be used for hi-res color control.

[PLOT [FLIP [CLPX [MCPL

These commands are used in plotting pixel points in hi-res graphics modes. The first three plot in 320 × 200 resolution two-color mode, the last in 160 × 200 resolution four-color mode. [PLOT sets the selected pixel on, [CLPX turns the pixel off, and [FLIP changes the pixel to the opposite state. [MCPL (multicolor plot) accepts horizontal coordinates in the range 0,159 and plots in one of four colors determined by sel, with sel in the range 0,3. A value of 0 selects background color, 1 selects text screen low-byte color, 2 selects text screen high-byte color, and 3 selects color memory color. Before you execute any of the plotting commands, [CB2K must be used to select the appropriate 8K block and [BMGR 1 must be in force for the plot

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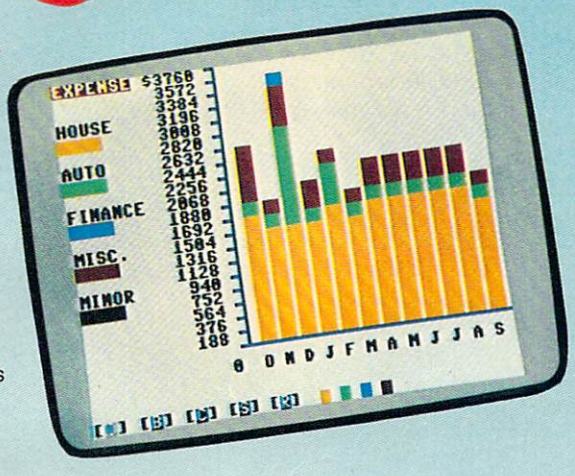

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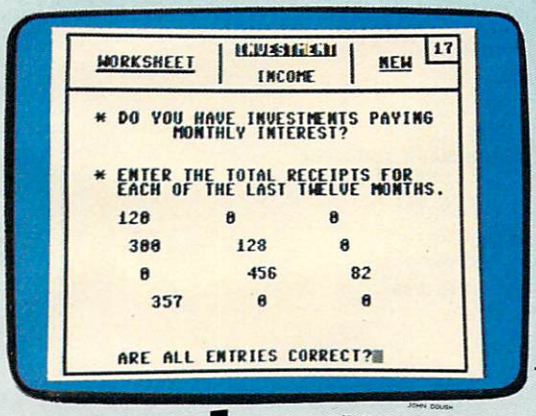

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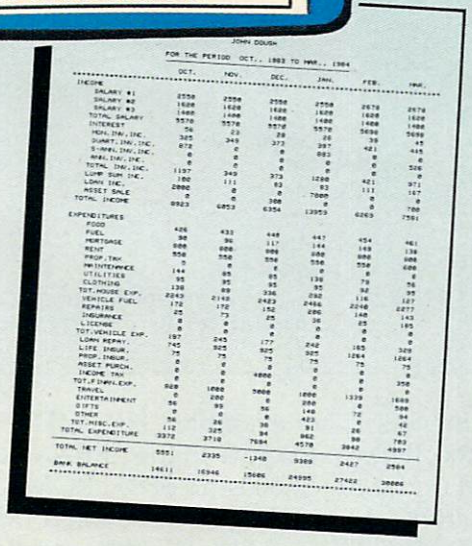

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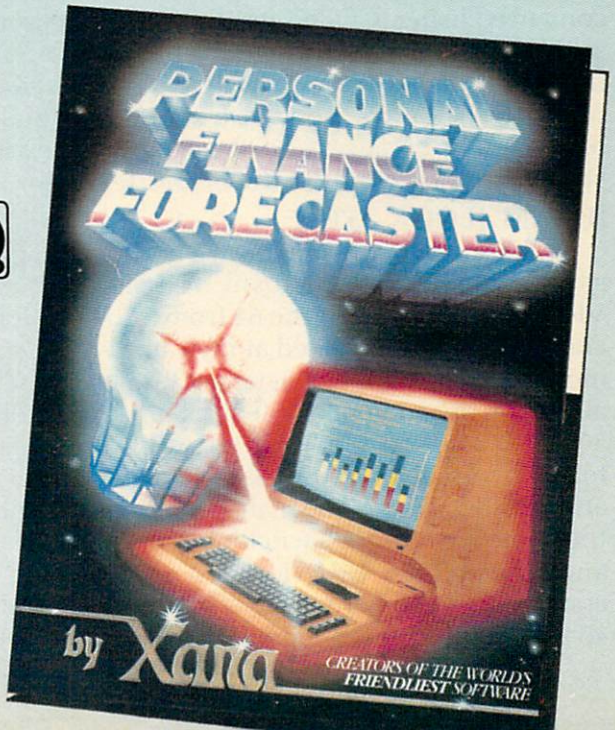

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to be seen. Remember that y coordinates increase as you go down the screen.

[DRAW

[DRAW is used to draw line segments on the hi-res screen. [CB2K and [BMGR must be used in preparation as in plot commands. [DRAW connects the endpoints given in the parameter list. The line is drawn from x1,y1 toward x2,y2.

[HRCS [CHAR [CHRX [CODE

These commands make it easy to put text on the hi-res screen. [HRCS (hi-res character set) stores the address of the character set to be used. It need not be located on a 2K boundary or even be the same set as used on the text screen. The address given is of the first byte of the set. A value of 53248 will select the ROM set (upper/graphics). [CHAR and [CHRX plot an 8×8 character to a selected position on the current hi-res screen. The character code (char) to select which character to plot corresponds to the screen POKE codes as listed in Commodore documentation. Example: [CHAR 1,100,100 would plot the letter A with position 100,100 being the upper-left corner of the 8 × 8 character cell. [CHAR plots the cell to the hi-res screen absolutely while [CHRX uses the exclusive OR function to flip the cell pixels. So [CHRX can be used to unplot a previously plotted character. [CODE helps in translating to the screen POKE code used by [CHAR and [CHRX in character selection.

The argument for [CODE must be the name of a defined string variable. Upon execution the ASCII values stored in the string will be converted to screen POKE codes. The RVS ON and RVS OFF control characters can be used within the string to select the upper 128 or lower 128 characters of the set. All other control characters will produce unpredictable results. Once the string is converted using [CODE, use the ASC function and MID$ function to read the codes. The ASC function will give correct results for the 0 character of the set. Be careful when using strings not built to high memory because [CODE will modify the actual string data stored within the BASIC text area.

[HRAM [LOOK [STUF

These commands make use of [BANK 3 possible from BASIC. When bank 3 is selected, the VIC chip uses RAM in the 64 from $C000 to $FFFF and ignores ROM located at the same addresses, including the ROM character set. SuperBASIC allows the location of one text screen ([VS1K block 3 located at $CC00) in bank 3. RAM from $D000 to $FFFF can be used for character sets, sprites, and a hi-res screen. The main problem confronting the bank 3 user is the switching required to read and write to these RAM locations. All plotting commands need to read as well as write to RAM so they can be preceded by [HRAM to accomplish this in bank 3. For example, [HRAMDRAW 1,0,100,100 would draw to the hi-res screen in RAM under the $E000 and $F000 ROMs. [HRAM should be used in this manner with [PLOT, [FLIP, [CLPX, [MCPL, [DRAW, [CHAR, and [CHRX in bank 3. [MXGR should be avoided in bank 3. Using the first 3K of bank 3 will crash SuperBASIC, so make sure the text screen is relocated by [VS1K 3. When the transition to bank 3 is accomplished,

SuperBASIC Commands

```
Enhanced BASIC Commands
    RESTORE <exp>
    GOTO <exp>
    GOSUB <exp>
    IF <exp> GOTO <exp>
    IF <exp> GOSUB <exp>
    ON <exp> GOTO <exp1>,<exp2>,...
    ON <exp> GOSUB <exp1>,<exp2>,...
    LIST (Shift Key halts list)
New SuperBASIC Commands
  Sprite Commands
    [DSPR spr,blk,xexp,yexp,xpos,ypos,multi,
      sprcolr,mc0,mc1
    [MOVE spr,xpos,ypos
    [KSPR spr
    [ESPR spr
    [BSPP spr,sel
  Sound Commands
    [SSND voice,ad,sr,wave,freq,pwidth
    [PLAY 256*wave+voice,freq,pwidth
  VIC Color Control
    [BKGD col
    [BKG4 col0,col1,col2,col3
    [EXTC col
    [FCOL col
  VIC Memory Mapping
    [BANK sel
    [VS1K sel
    [CB2K sel
  Graphics Control
    [ECGR sel
    [MCGR sel
    [BMGR sel
    [MXGR reg,mask,rast1,val1,rast2,val2
    [KMXG
    [CMXV val1,val2
    [SIZE colsel,rowsel
    [XYSC xpos,ypos
    [DLCS set,address
    [FBMS byte
    [FSCR byte
    [PLOT x,y
    [FLIP x,y
    [CLPX x,y
    [MCPL x,y,sel
    [DRAW x1,y1,x2,y2
    [HRCS address
    [CHAR char,x,y
    [CHRX char,x,y
    [CODE str$
    [LOOK address, variable
    [STUF address,byte
    [HRAM <SuperBASIC mnemonic>
          <parameter list>
```

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the 1K block at $0400 can be reclaimed for BASIC program storage. [LOOK and [STUF are PEEK and POKE equivalents that can be used with [HRAM to examine and change RAM. [LOOK is different from PEEK in that a defined variable name is used in the parameter list to store the value read from memory. [STUF works the same as POKE and is primarily useful for storing to block $D000 RAM (for example, [HRAMSTUF 53248,255).

Programs 2 – 6 are demonstration programs which should be helpful in seeing the commands used in actual applications.

If you're not up to typing in SuperBASIC yourself, send $3 along with a blank disk (no tapes) and a stamped, self-addressed mailer to:

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Program 1: SuperBASIC 64

```
2049 :011,008,000,000,158,050,228
2055 :048,056,048,000,000,000,159
2061 :000,000,000,000,000,000,013
2067 :000,000,000,000,000,000,019
2073 :000,000,000,000,000,000,025
2079 :000,169,039,133,001,169,030
2085 :000,133,020,133,078,169,058
2091 :009,133,021,169,192,133,188
2097 :079,162,012,160,000,177,127
2103 :020,145,078,200,208,249,187
2109 :230,021,230,079,202,208,007
2115 :242,160,008,169,104,032,014
2121 :030,171,169,013,141,119,204
2127 :002,141,120,002,169,002,003
2133 :133,198,169,033,141,001,248
2139 :008,169,020,141,002,008,183
2145 :076,120,008,000,000,000,045
2151 :000,031,147,017,017,048,107
2157 :017,157,082,085,078,019,035
2163 :000,000,000,000,000,169,028
2169 :000,133,020,169,160,133,224
2175 :021,162,032,160,000,177,167
2181 :020,145,020,136,208,249,143
2187 :230,021,202,208,244,162,182
2193 :000,160,003,185,224,160,109
2199 :157,224,160,232,200,224,068
2205 :190,208,244,169,003,141,088
2211 :161,168,169,192,141,162,132
2217 :168,169,074,141,210,166,073
2223 :169,193,141,211,166,141,172
2229 :037,160,169,084,141,036,040
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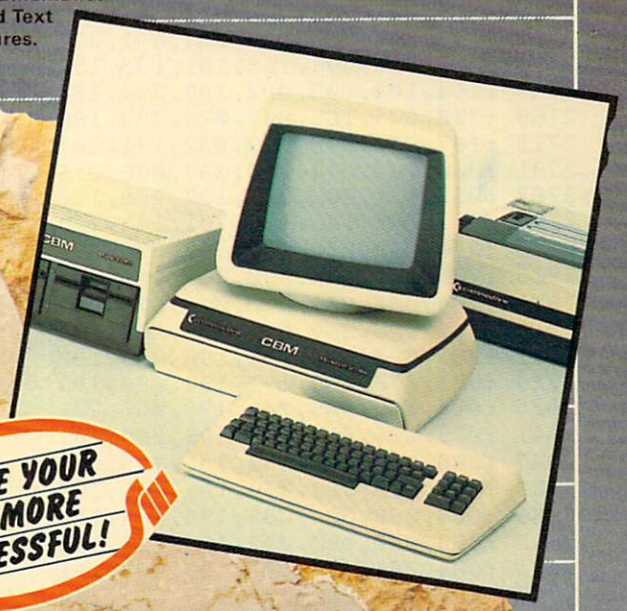

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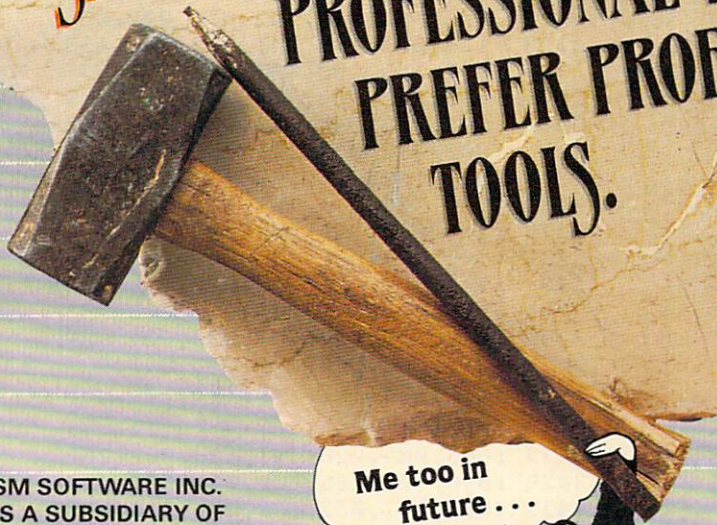

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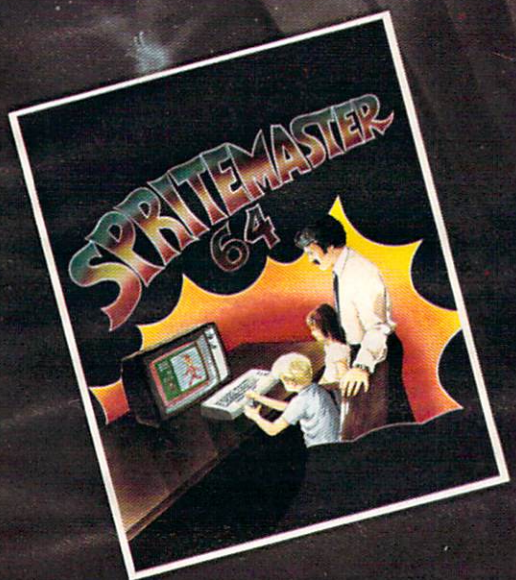

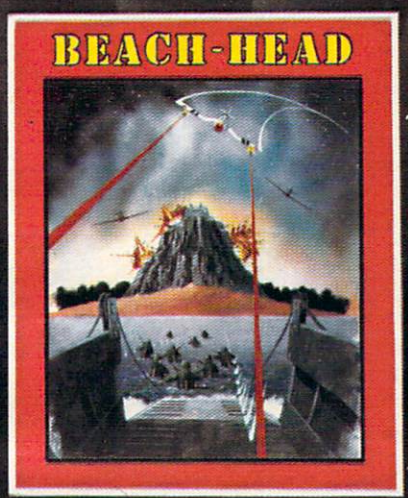

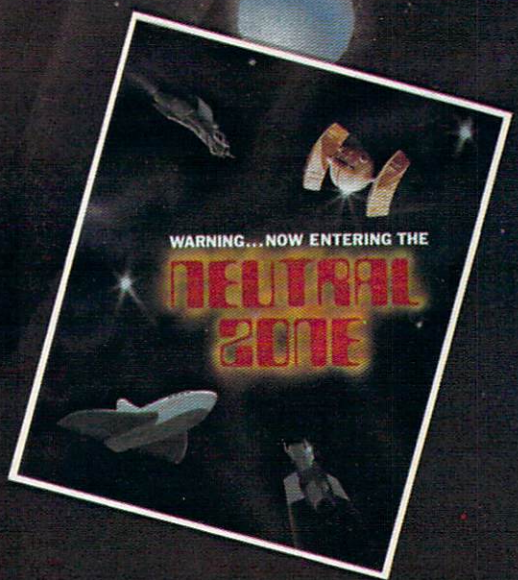

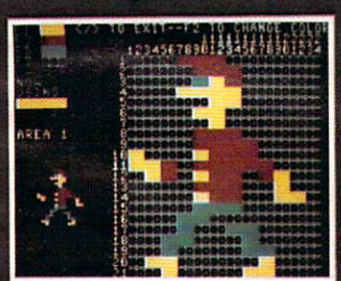

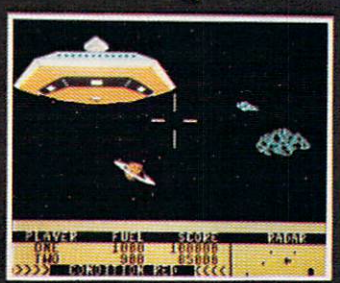

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```
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```

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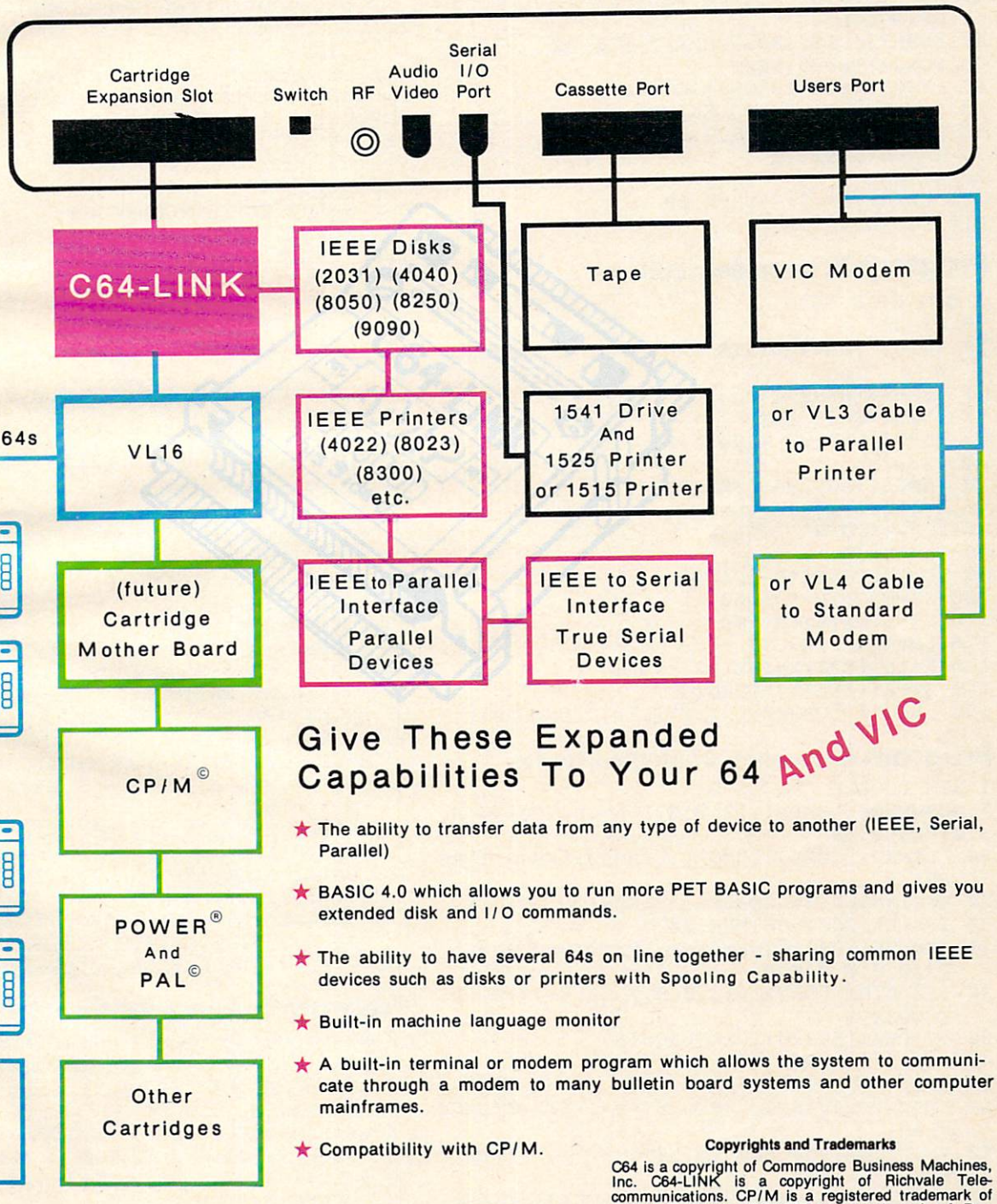

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Program 2: Moiré Pattern

```
1 REM MOIRE TITLE PAGE DEMO
5 [EXTC0
10 [CB2K4:[BMGR1:[FBMS0 :[FSCR1
15 FORJ=0 TO318 STEP2
20 [DRAWJ,198,160,100 :NEXT
22 FORJ=0 TO318 STEP2
23 [DRAWJ,0,160,100 :NEXT
24 FORJ=0 TO198 STEP2
25 [DRAW160,100,318,J{3 SPACES}:NEXT
26 FORJ=0 TO198 STEP2
27 [DRAW161,100,0,J{3 SPACES}:NEXT
29 [EXTC4
30 M$="SUPERBASIC":[HRCS53248:M$=M$+""
40 X=120:Y=80:GOSUB50
45 M$="{RVS}BY MCSOFT":M$=M$+"":X=124:Y=1
   20:GOSUB50
47 [CHRX54,152,89:[CHRX52,160,89
48 FORJ=1TO800:NEXT
49 [FSCR16:{5 SPACES}GOTO100
50 [CODEM$:FORJ=1TOLEN(M$)
60 [CHRXASC(MID$(M$,J,1)),X,Y
70 X=X+8:NEXT
80 RETURN
100 GETA$:IFA$=""THEN100
110 [BMGR0:[CB2K2
```

Program 3: Geometric Pattern

```
1 REM STAR DEMO
10 PI=2*↑
20 INPUT"{CLR}POINTS WANTED (0 TO END)";P
   W
21 IFPW=0THENEND
22 INPUT"SKIP";SK
23 INPUT"RADIUS <100 ";R
30 P=PI/PW
50 [BMGR1:[CB2K4:[FBMS0:[FSCR1
60 X=160:Y=100-R:TL=0
70 FORJ=1TOPW
80 TH=TL+SK
90 TL=TH:TH=TH*P-(PI/4)
100 X2=COS(TH)*R+160
110 Y2=SIN(TH)*R+100
120 [DRAWX,Y,X2,Y2
130 X=INT(X2):Y=INT(Y2):NEXT
140 GETA$:IFA$=""THEN140
150 [BMGR0:[CB2K2:PRINT"{CLR}":GOTO20
```

Program 4: Joystick-Controlled Sprites

```
1 REM DOODLE
5 GOSUB900:[DSPR1,13,0,0,160+16,100+44,0,
  0:GOSUB140
10 [BANK0:[CB2K4:[BMGR1:[FBMS0:[FSCR1:[BS
   PP1,1
20 E=1:X=160:Y=100:C=-1:FORQ=1TO100:NEXT
30 IFPEEK(203)=60THEN130
31 IFPEEK(203)=4THENE=-E:IFE>0THEN[DSPR1,
   13,0,0,0,0,0,0
32 IFE<0THEN[DSPR1,13,0,0,X+16,Y+44,0,12:
   [CLPXX,Y
35 JV=PEEK(56320):FR=JVAND16
40 JV=15-(JVAND15)
50 IFJV=0ANDFR=16THEN30
60 IFJV=1ORJV=5ORJV=9THENY=Y-1:IFY<0THENY
   =199
70 IFJV=2ORJV=6ORJV=10THENY=Y+1:IFY>199TH
   ENY=0
80 IFJV>=4ANDJV<=6THENX=X-1:IFX<0THENX=31
   9
90 IFJV>=8ANDJV<=10THENX=X+1:IFX>319THENX
   =0
100 IFFR=0ANDJV=0THENC=-C:E=1:FORQ=1TO100
    :NEXT:IFC>0THEN[KSPR1:POKE53288,0
105 IFE<0THEN[ESPR1:[MOVE1,X+16,Y+44:[CLP
    XX,Y:GOTO30
110 IFC>0THEN[PLOTX,Y:GOTO30
120 IFC<0THEN[ESPR1:[MOVE1,X+16,Y+44:GOTO
    30
130 [BANK0:[BMGR0:[CB2K2:POKE198,0:PRINT"
    {CLR}":[KSPR1:END
140 PRINT"{CLR}DOODLE 64"
150 PRINT"{DOWN}USE JOYSTICK IN PORT 2"
160 PRINT"BUTTON TURNS INK ON/OFF"
165 PRINT"F1 TURNS ERASE MODE ON/OFF"
170 PRINT"HIT A KEY TO START"
180 PRINT"HIT {RVS}SPACE{OFF} TO STOP"
185 PRINT"THE BLACK + IS YOUR CURSOR WHEN
     INK=OFF"
186 PRINT"THE GREY + IS YOUR CURSOR WHEN
    {SPACE}ERASE=ON":[BKGD1:[FCOL0
190 GETA$:IFA$=""THEN190
200 IFA$=" "THENRETURN
210 RETURN
900 X=13*64
910 READY:IFY<0THENRETURN
920 POKEX,Y:X=X+1:GOTO910
1000 DATA1,192,0,1,192,0,1,192,0,1,192,0,
     1,192,0
1010 DATA0,128,0,126,63,0,0,128,0,1,192,0
     ,1,192,0
1020 DATA1,192,0,1,192,0,1,192,0,0,0,0,0,
     0,0
1030 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
1040 DATA0,0,0,-1
```

Program 5: Sprite Animation

```
1 REM FALLING SHAMROCKS
2 REM HIT A KEY TO STOP PROGRAM
5 [EXTC13:[CB2K4:[BMGR1:[FSCR5:[FBMS171
10 X=832:V=53265:R=128
20 READA:IFA<0THEN35
30 POKEX,A:X=X+1:GOTO20
35 FORJ=0TO7
40 [DSPRJ,13,1,1,0,0,0,5+J{2 SPACES}:NEXT
50 FORJ=1TO256:FORK=1TO8:[MOVEK-1,J+K*K,J
   *K+K:NEXT:WAITV,R:[FSCRJ/2
55 GETA$:IFA$<>""THEN300
56 NEXT
60 X=PEEK(8192)+1:[FBMSX:GOTO50
100 DATA0,102,0,0,255,0,1,255,128,3,255,1
    92
110 DATA3,255,192,25,255,152,60,126,60,12
    6,126,126
120 DATA255,60,255,255,255,255,127,255,25
    4,255,255,255,255
130 DATA24,255,126,24,126,60,24,60,24,24,
    24,0,24,0,0,24,0,0,0,0,0,0,0,0,0,0,-1
300 [CB2K2:[BMGR0:FORJ=0TO7:[KSPRJ:NEXT
```

Program 6: Simple PET Emulator

```
10 REM ROUTINE TO SET BASIC MEMORY AND SC
   REEN TO PET STANDARD LOCATIONS
20 REM SCREEN AT 32768
30 REM BASIC 1024 TO 32767
40 REM ASSUME IN C-64 STANDARD MAP
50 [FSCR 0:[VS1K 0 :[BANK 2 :PRINT"{CLR}"
60 POKE44,4:POKE 45,3:POKE46,4
70 POKE55,0:POKE56,128
80 NEW
```

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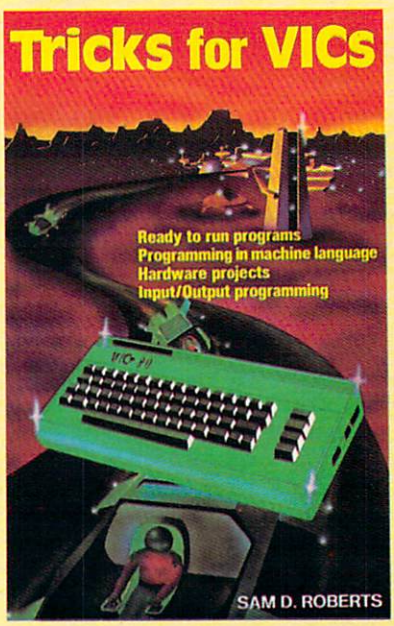

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MLX

Machine Language Entry Program For Atari And Commodore 64

Charles Brannon, Program Editor

Even the best typists have problems entering machine languare programs as BASIC loaders. Here's the solution.

Have you ever typed in a long machine language program? Chances are you typed in hundreds of DATA statements, numbers, and commas. You're never sure if you've typed them in right. So you go back, proofread, try to run the program, crash, go back and proofread again, correct a few typing errors, run again, crash, recheck your typing — frustrating, isn't it?

Until now, though, that has been the best way to enter machine language into your computer. Unless you happen to own an assembler and are willing to wrangle with machine language on the assembly level, it is much easier to enter a BASIC program that reads the DATA statements and POKEs the numbers into memory.

Some of these *BASIC loaders*, as they are known, use a *checksum* to see if you've typed the numbers correctly. The simplest checksum is just the sum of all the numbers in the DATA statements. If you make an error, your checksum will not match up. Some programmers make the task easier by calculating checksums every ten lines or so, and you can thereby locate your errors more easily.

Almost Foolproof

"MLX" lets you type in long machine language (ML) listings with almost foolproof results. Using MLX, you enter the numbers from a special list that looks similar to BASIC DATA statements. MLX checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers, such as a lowercase L for a 1 or an O for a 0. It won't let you enter numbers greater than 255, which are not permitted in ML DATA statements. It *will* prevent you from entering the wrong numbers on the wrong line. In short, MLX should make proofreading obsolete!

In addition, MLX will generate a ready-to-use tape or disk file. For the 64, you can then use the LOAD command to read the program into the computer, just as you would with any program. Specifically, you enter:

```
LOAD "program",1,1   (for tape)
```

or

```
LOAD "program",8,1   (for disk)
```

To start the program you need to enter a SYS command that transfers control from BASIC to machine language. The starting SYS will always be given in the article accompanying the machine language program.

For the Atari, MLX will generate a ready-to-use boot tape or boot disk. It also has an option to create binary files for DOS users. A boot disk is like the disks sold with professional games on them. You just insert the disk, remove any cartridges, and turn on your computer. The game will then automatically load.

Boot Tapes

Using a boot tape is almost as simple. Just insert it into your player, rewind, press PLAY. Hold down the START key while turning on your com-

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WHERE WINNING IS THE PITS.

You'll never make Grand Prix champion just driving in circles.

You've got to stop sometime. The question is when. Right now you're in the lead. But the faster you go, the more gas you consume. And the quicker your tires wear down.

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See your retailer for available computer formats.

So what'll it be, Mario? Think your tires will hold up for another lap? Or should you play it safe and go get some new ones?

Think it over. Because Pitstop™ is the one and only road race game where winning is more than just driving. It's the pits.

Goggles not included.

One or two players; 6 racecourses, joystick control.

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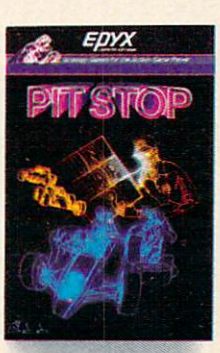

puter until you hear a beep (like the one you hear with CLOAD). Then press a key on the keyboard and the program will automatically load and run.

Incidentally, the binary file is more useful for utilities than games. Binary files are loaded from the DOS menu (selection L) or automatically if the file is named "AUTORUN.SYS". If you can't stand the thought of putting only one game on each disk (as with boot disks), you can place several binary file machine language games on one disk.

Getting Started

To get started, type in and save MLX (you'll need it for future ML programs published in COMPUTE!). When you're ready to type in the ML program, the program will ask you for several numbers: the starting address and the ending address. In addition, the Atari MLX will request a "Run/Init Address". These vital numbers can be found in the appropriate article accompanying the ML program.

The Atari version will then ask you to press either T for a boot tape, or D for disk. If you press D, you'll be asked if you want to generate a boot disk (press D) or a binary file (press F).

Next you'll see a prompt. The prompt is the current line you are entering from the listing. Each line is six numbers plus a checksum. If you enter any of the six numbers wrong, or enter the checksum wrong, MLX will ring a buzzer and prompt you to reenter the line. If you enter it correctly, a pleasant bell tone will sound and you proceed to the next line.

A Special Editor

You are not using the normal Atari or Commodore 64 screen editor with MLX. For example, it will accept only numbers as input. If you need to make a correction, press ‹DEL/BACK S› (Atari) or ‹INST/DEL› (64). The entire number is deleted. You can press it as many times as necessary back to the start of the line. If you enter three-digit numbers as listed, the computer will automatically print the comma and prepare to accept the next number. If you enter less than three digits (by omitting leading zeros), you can press either the comma, space bar, or RETURN key to advance to the next number. When you get to the checksum value, the Atari MLX will emit a low drone to remind you to be careful. The checksum will automatically appear in inverse video; don't worry, it's highlighted for emphasis.

When testing MLX, we've found that it makes entering long listings extremely easy. With the audio cues provided, you don't even have to look at the screen if you're a touch-typist. We have tested MLX with people lacking any computer background whatsoever. No one has ever managed to enter a listing wrong with it.

Done At Last!

When you finish typing (assuming you type the entire listing in one session) you can then save the completed program on tape or disk. Follow the screen instructions. With a boot disk, the Atari version will offer to format the disk. If you press Y (yes), be sure you have a blank disk in drive one — not your program disk! If you get any errors while saving, you probably have a bad disk, or the disk is full, or you made a typo when entering the actual MLX program. (Remember, it can't check itself!)

Command Control

What if you don't want to enter the whole program in one sitting? MLX lets you enter as much as you want, save that portion, and then reload the file from tape or disk when you want to continue. MLX recognizes these few commands:

S: SAVE
L: LOAD
N: New Address
D: Display

For the Atari, hold down the CTRL key while you type the appropriate key. Hold down SHIFT on the 64 to enter a command key. You will jump out of the line you've been typing, so it's best to perform these commands at a new prompt. Use the SAVE command to save what you've been working on. It will write the tape or disk file as if you've finished, but the tape or disk won't work, of course, until you finish the typing. *Remember what address you stop on.* The next time you run MLX, answer all the prompts as you did before, then insert the disk or tape. When you get to the entry prompt, press CTRL-L (Atari) or SHIFT-L (64) to reload the file into memory. You'll then use the New Address command to resume typing.

New Address And Display

Here's how the New Address command works. After you press SHIFT-N or CTRL-N, enter the address where you previously stopped. The prompt will change, and you can then continue typing. Always enter a New Address that matches up with one of the line numbers in the special listing, or else the checksum won't match up.

You can use the Display command to display a section of your typing. After you press CTRL-D or SHIFT-D, enter two addresses within the line number range of the listing. You can abort the listing by pressing any key.

Tricky Business

The special commands may seem a little confusing at first, but as you work with MLX, they will become easy and valuable. What if you forgot where you stopped typing, for instance? Use the Display

SHOOT THE WORKS with an ARROW™

Have you been spending too much time with your VIC? If it's because you are always waiting for your programs to load, Skyles Electric Works can help.

Enter the Arrow.

This cartridge can load programs off cassette at about eight times the normal speed. It can re-record a program *once* at up to eight times the density on tape. This means that you can get 200 kbytes of programs on a single C-20 tape. In the long run, you'll be able to put 10 tapes into one. The Arrow cartridge will pay for itself in the tape and the vast amount of leading time it saves.

And it's easy to use.

ARROW . . . . . adds 4 commands: ←S, ←L, ←V, and ←A that are used to SAVE, LOAD, VERIFY AND APPEND at a *high speed* (3600 baud).

ARROW . . . . . leaves the usual messages that appear on the screen.

ARROW . . . . . adds a message telling you the length of the program that has been loaded (or saved).

ARROW . . . . . keeps all of the usual shorthand features of program naming.

ARROW . . . . . starts automatically when you turn on your VIC-20 or CBM-64.

It gives the length of the program that it has loaded or saved. It can handle hexadecimal/decimal calculations; it even has a machine language monitor in it. Bull's-eye!

And advanced programmers can get an optional machine language assembler in the same cartridge. Even though it speeds up program loading it does not effect the tape recorder. It's an *extremely* reliable device.

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But this great device does more than cut down on loading time and tape space. It is a fine programmer's aid, too. With some sharp but simple program text editing commands, the Arrow might be the best bargain around in personal software for your VIC. The Arrow is always on target with auto line numbering and line deleting features.

ARROW . . . . . adds the following programming aids:

AUTOLINE numbering
RENUMBERING of lines
DELETE a line or group of lines
SEARCH with optional replace
MOVE a block of memory
COMPARE two blocks of memory
HEXADECIMAL/DECIMAL calculator converter
XIT two machine language monitor with: Display, Go, Register, Save, Load and Exit commands

Only $49.95 for the VIC or Commodore 64 version. The high-speed cartridge with machine language assembler costs just $89.95. And the easy-to-use Arrow comes with the clear Skyles manual.

AR20 (VIC-20), AR64 (CBM-64) $49.95
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command to scan memory from the beginning to the end of the program. When you see a bunch of 170s (64) or zeros (Atari), stop the listing by pressing a key and continue typing where the 170s (or zeros) start. Some programs contain many sections of these zeros or 170s. To avoid typing them, you can use the New Address command to skip over these blocks. Be careful, though; you don't want to skip over anything you *should* type.

Making Copies

You can use the MLX SAVE and LOAD commands to make copies of the completed ML program. Use LOAD to reload the tape or disk, then insert a new tape or disk and use the SAVE command to make a new copy.

One quirk about tapes made with the 64 MLX SAVE command: When you load them, the message "FOUND program" may appear twice. The tape will load just fine, however.

We hope you will find MLX to be a true labor-saving utility. Since it has been thoroughly tested by entering actual programs, you can count on it as an aid for generating bug-free machine language. And be sure to save MLX; it will be used for future all-machine-language programs in COMPUTE!, COMPUTE!'s Gazette, and COMPUTE! Books.

Program 1: MLX — 64 Version

```
100 PRINT"{CLR}{RED}";CHR$(142);CHR$(8);:
    POKE53281,1:POKE53280,1
101 POKE 788,52:REM DISABLE RUN/STOP
110 PRINT"{RVS}{40 SPACES}";
120 PRINT"{RVS}{15 SPACES}{RIGHT}{OFF}
    [*]£{RVS}{RIGHT} {RIGHT}{2 SPACES}
    [*][OFF][*]£{RVS}£{RVS}
    {13 SPACES}";
130 PRINT"{RVS}{15 SPACES}{RIGHT} [G]
    {RIGHT} {2 RIGHT} {OFF}£{RVS}£[*]
    {OFF}[*]{RVS}{13 SPACES]";
140 PRINT"{RVS}{40 SPACES}"
150 V=53248:POKE2040,13:POKE2041,13:FORI=
    832TO894:POKEI,255:NEXT:POKEV+27,3
160 POKEV+21,3:POKEV+39,2:POKEV+40,2:POKE
    V,144:POKEV+1,54:POKEV+2,192:POKEV+3,
    54
170 POKEV+29,3
180 FORI=0TO23:READA:POKE679+I,A:POKEV+39
    ,A:POKEV+40,A:NEXT
185 DATA169,251,166,254,164,255,32,216,25
    5,133,253,96
187 DATA169,0,166,251,164,252,32,213,255,
    133,253,96
190 POKEV+39,7:POKEV+40,7
200 PRINT"{2 DOWN}{PUR}{BLK}{3 SPACES}A F
    AILSAFE MACHINE LANGUAGE EDITOR
    {5 DOWN}"
210 PRINT"[5]{2 UP}STARTING ADDRESS?
    {8 SPACES}{9 LEFT}";:INPUTS:F=1-F:C$=
    CHR$(31+119*F)
220 IFS<256OR(S>40960ANDS<49152)ORS>53247
    THENGOSUB3000:GOTO210
225 PRINT:PRINT:PRINT
230 PRINT"[5]{2 UP}ENDING ADDRESS?
    {8 SPACES}{9 LEFT}";:INPUTE:F=1-F:C$=
    CHR$(31+119*F)
240 IFE<256OR(E>40960ANDE<49152)ORE>53247
    THENGOSUB3000:GOTO230
250 IFE<STHENPRINTC$;"{RVS}ENDING < START
    {2 SPACES}":GOSUB1000:GOTO 230
260 PRINT:PRINT:PRINT
300 PRINT"{CLR}";CHR$(14):AD=S:POKEV+21,0
310 PRINTRIGHT$("0000"+MID$(STR$(AD),2),5
    );":";:FORJ=1TO6
320 GOSUB570:IFN=-1THENJ=J+N:GOTO320
390 IFN=-211THEN 710
400 IFN=-204THEN 790
410 IFN=-206THENPRINT:INPUT"{DOWN}ENTER N
    EW ADDRESS";ZZ
415 IFN=-206THENIFZZ<SORZZ>ETHENPRINT"
    {RVS}OUT OF RANGE":GOSUB1000:GOTO410
417 IFN=-206THENAD=ZZ:PRINT:GOTO310
420 IF N<>-196 THEN 480
430 PRINT:INPUT"DISPLAY:FROM";F:PRINT,"TO
    ";:INPUTT
440 IFF<SORF>EORT<SORT>ETHENPRINT"AT LEAS
    T";S;"{LEFT}, NOT MORE THAN";E:GOTO43
    0
450 FORI=FTOTSTEP6:PRINT:PRINTRIGHT$("000
    0"+MID$(STR$(I),2),5);":";
451 FORK=0TO5:N=PEEK(I+K):PRINTRIGHT$("00
    "+MID$(STR$(N),2),3);",";
460 GETA$:IFA$>""THENPRINT:PRINT:GOTO310
470 NEXTK:PRINTCHR$(20);:NEXTI:PRINT:PRIN
    T:GOTO310
480 IFN<0 THEN PRINT:GOTO310
490 A(J)=N:NEXTJ
500 CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CK
    SUM=(CKSUM+A(I))AND255:NEXT
510 PRINTCHR$(18);:GOSUB570:PRINTCHR$(20)
515 IFN=CKSUMTHEN530
520 PRINT:PRINT"LINE ENTERED WRONG : RE-E
    NTER":PRINT:GOSUB1000:GOTO310
530 GOSUB2000
540 FORI=1TO6:POKEAD+I-1,A(I):NEXT:POKE54
    272,0:POKE54273,0
550 AD=AD+6:IF AD<E THEN 310
560 GOTO 710
570 N=0:Z=0
580 PRINT"[+]";
581 GETA$:IFA$=""THEN581
585 PRINTCHR$(20);:A=ASC(A$):IFA=13ORA=44
    ORA=32THEN670
590 IFA>128THENN=-A:RETURN
600 IFA<>20 THEN 630
610 GOSUB690:IFI=1ANDT=44THENN=-1:PRINT"
    {LEFT} {LEFT}";:GOTO690
620 GOTO570
630 IFA<48ORA>57THEN580
640 PRINTA$;:N=N*10+A-48
650 IFN>255 THEN A=20:GOSUB1000:GOTO600
660 Z=Z+1:IFZ<3THEN580
670 IFZ=0THENGOSUB1000:GOTO570
680 PRINT",";:RETURN
690 S%=PEEK(209)+256*PEEK(210)+PEEK(211)
691 FORI=1TO3:T=PEEK(S%-I)
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
700 PRINTLEFT$("{3 LEFT}",I-1);:RETURN
710 PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
720 INPUT"{DOWN} FILENAME";F$
730 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
    {RVS}D{OFF}ISK: (T/D)"
740 GETA$:IFA$<>"T"ANDA$<>"D"THEN740
750 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
760 OPEN 1,DV,1,F$:POKE252,S/256:POKE251,
```

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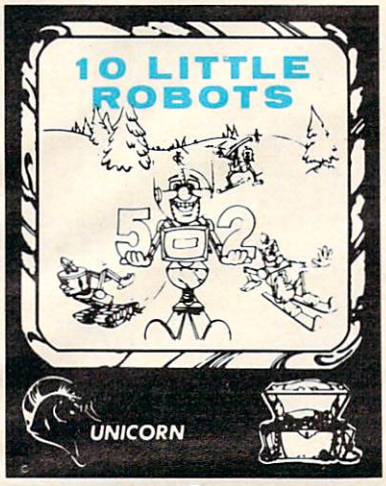

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Available for the Apple, Atari, Commodore 64 and IBM computers.

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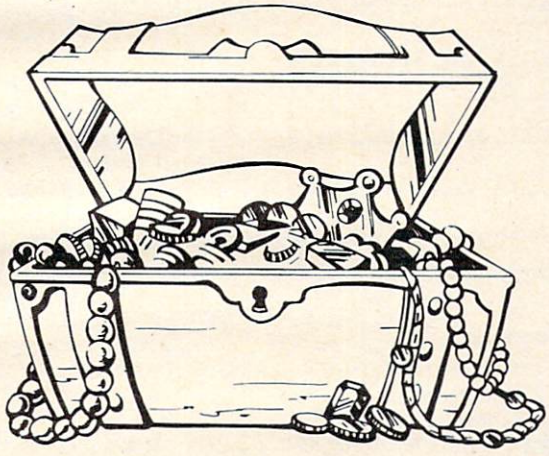

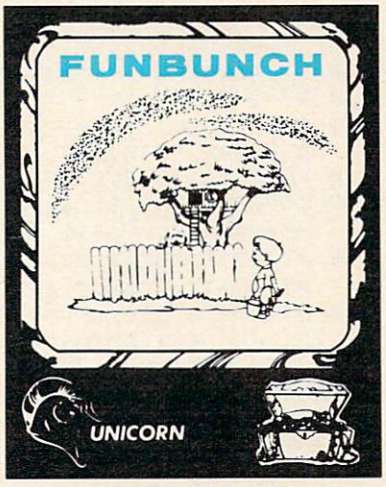

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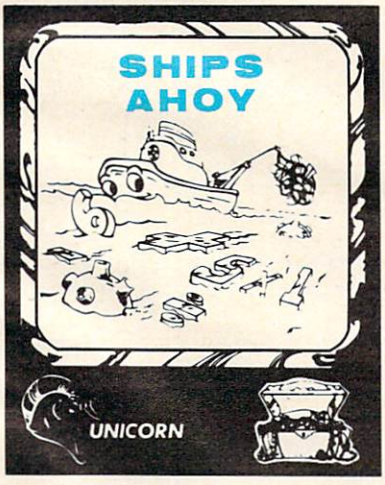

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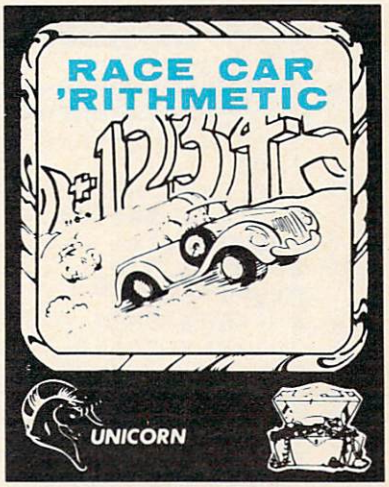

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```
    S-PEEK(252)*256
765 POKE255,E/256:POKE254,E-PEEK(255)*256
770 POKE253,10:SYS 679:CLOSE1:IFPEEK(253)
    >90RPEEK(253)=0THENPRINT"{DOWN}DONE."
    :END
780 PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}T
    RY AGAIN.":IFDV=1THEN720
781 OPEN15,8,15:INPUT#15,DS,DS$:PRINTDS;D
    S$:CLOSE15:GOTO720
790 PRINT"{CLR}{RVS}*** LOAD ***{2 DOWN}"
800 INPUT"{2 DOWN} FILENAME";F$
810 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
     {RVS}D{OFF}ISK: (T/D)"
820 GETA$:IFA$<>"T"ANDA$<>"D"THEN820
830 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
840 OPEN 1,DV,0,F$:POKE252,S/256:POKE251,
    S-PEEK(252)*256
850 POKE253,10:SYS 691:CLOSE1
860 IFPEEK(253)>9 OR PEEK(253)=0 THEN PRI
    NT:PRINT:GOTO310
870 PRINT"{DOWN}ERROR ON LOAD.{2 SPACES}T
    RY AGAIN.{DOWN}":IFDV=1THEN800
880 OPEN15,8,15:INPUT#15,DS,DS$:PRINTDS;D
    S$:CLOSE15:GOTO800
1000 REM BUZZER
1001 POKE54296,15:POKE54277,45:POKE54278,
     165
1002 POKE54276,33:POKE 54273,6:POKE54272,
     5
1003 FORT=1TO200:NEXT:POKE54276,32:POKE54
     273,0:POKE54272,0:RETURN
2000 REM BELL SOUND
2001 POKE54296,15:POKE54277,0:POKE54278,2
     47
2002 POKE 54276,17:POKE54273,40:POKE54272
     ,0
2003 FORT=1TO100:NEXT:POKE54276,16:RETURN
3000 PRINTC$;"{RVS}NOT ZERO PAGE OR ROM":
     GOTO1000
```

Program 2: MLX — Atari Version

```
100 GRAPHICS 0:DL=PEEK(560)+256*PEEK
    (561)+4:POKE DL-1,71:POKE DL+2,6
110 POSITION 8,0:? "MLX":POSITION 23
    ,0:? "failsafe entry":POKE 710,0
    :?
120 ? "Starting Address";:INPUT BEG:
    ? "  Ending Address";:INPUT FIN:
    ? "Run/Init Address";:INPUT STAR
    TADR
130 DIM A(6),BUFFER$(FIN-BEG+127),T$
    (20),F$(20),CIO$(7),SECTOR$(128)
    ,DSKINV$(6)
140 OPEN #1,4,0,"K:":? :? ,"Tape or
    Disk:";
150 BUFFER$=CHR$(0):BUFFER$(FIN-BEG+
    30)=BUFFER$:BUFFER$(2)=BUFFER$:S
    ECTOR$=BUFFER$
160 ADDR=BEG:CIO$="hhh":CIO$(4)=CHR$
    (170):CIO$(5)="LV":CIO$(7)=CHR$(
    228)
170 GET #1,MEDIA:IF MEDIA<>84 AND ME
    DIA<>68 THEN 170
180 ? CHR$(MEDIA):? :IF MEDIA<>ASC("
    T") THEN BUFFER$="":GOTO 250
190 BEG=BEG-24:BUFFER$=CHR$(0):BUFFE
    R$(2)=CHR$((FIN-BEG+127)/128)
200 H=INT(BEG/256):L=BEG-H*256:BUFFE
    R$(3)=CHR$(L):BUFFER$(4)=CHR$(H)
210 PINIT=BEG+8:H=INT(PINIT/256):L=P
    INIT-H*256:BUFFER$(5)=CHR$(L):BU
    FFER$(6)=CHR$(H)
220 FOR I=7 TO 24:READ A:BUFFER$(I)=
    CHR$(A):NEXT I:DATA 24,96,169,60
    ,141,2,211,169,0,133,10,169,0,13
    3,11,76,0,0
230 H=INT(STARTADR/256):L=STARTADR-H
    *256:BUFFER$(15)=CHR$(L):BUFFER$
    (19)=CHR$(H)
240 BUFFER$(23)=CHR$(L):BUFFER$(24)=
    CHR$(H)
250 IF MEDIA<>ASC("D") THEN 360
260 ? :? "Boot Disk or Binary File:"
    ;
270 GET #1,DTYPE:IF DTYPE<>68 AND DT
    YPE<>70 THEN 270
280 ? CHR$(DTYPE):IF DTYPE=70 THEN 3
    60
290 BEG=BEG-30:BUFFER$=CHR$(0):BUFFE
    R$(2)=CHR$((FIN-BEG+127)/128)
300 H=INT(BEG/256):L=BEG-H*256:BUFFE
    R$(3)=CHR$(L):BUFFER$(4)=CHR$(H)
310 PINIT=STARTADR:H=INT(PINIT/256):
    L=PINIT-H*256:BUFFER$(5)=CHR$(L)
    :BUFFER$(6)=CHR$(H)
320 RESTORE 330:FOR I=7 TO 30:READ A
    :BUFFER$(I)=CHR$(A):NEXT I
330 DATA 169,0,141,231,2,133,14,169,
    0,141,232,2,133,15,169,0,133,10,
    169,0,133,11,24,96
340 H=INT(BEG/256):L=BEG-H*256:BUFFE
    R$(8)=CHR$(L):BUFFER$(15)=CHR$(H
    )
350 H=INT(STARTADR/256):L=STARTADR-H
    *256:BUFFER$(22)=CHR$(L):BUFFER$
    (26)=CHR$(H)
360 GRAPHICS 0:POKE 712,10:POKE 710,
    10:POKE 709,2
370 ? ADDR;":";:FOR J=1 TO 6
380 GOSUB 570:IF N=-1 THEN J=J-1:GOT
    O 380
390 IF N=-19 THEN 720
400 IF N=-12 THEN LET READ=1:GOTO 72
    0
410 TRAP 410:IF N=-14 THEN ? :? "New
     Address";:INPUT ADDR:? :GOTO 37
    0
420 TRAP 32767:IF N<>-4 THEN 480
430 TRAP 430:? :? "Display:From";:IN
    PUT F:? ,"To";:INPUT T:TRAP 3276
    7
440 IF F<BEG OR F>FIN OR T<BEG OR T>
    FIN OR T<F THEN ? CHR$(253);"At
    least ";BEG;", Not More Than ";F
    IN:GOTO 430
450 FOR I=F TO T STEP 6:? :? I;":";:
    FOR K=0 TO 5:N=PEEK(ADR(BUFFER$)
    +I+K-BEG):T$="000":T$(4-LEN(STR$
    (N)))=STR$(N)
460 IF PEEK(764)<255 THEN GET #1,A:P
    OP :POP :? :GOTO 370
470 ? T$;",";:NEXT K:? CHR$(126);:NE
    XT I:? :? :GOTO 370
480 IF N<0 THEN ? :GOTO 370
490 A(J)=N:NEXT J
500 CKSUM=ADDR-INT(ADDR/256)*256:FOR
     I=1 TO 6:CKSUM=CKSUM+A(I):CKSUM
    =CKSUM-256*(CKSUM>255):NEXT I
510 RF=128:SOUND 0,200,12,8:GOSUB 57
    0:SOUND 0,0,0,0:RF=0:? CHR$(126)
520 IF N<>CKSUM THEN ? :? "Incorrect
    ";CHR$(253);:? :GOTO 370
530 FOR W=15 TO 0 STEP -1:SOUND 0,50
    ,10,W:NEXT W
540 FOR I=1 TO 6:POKE ADR(BUFFER$)+A
```

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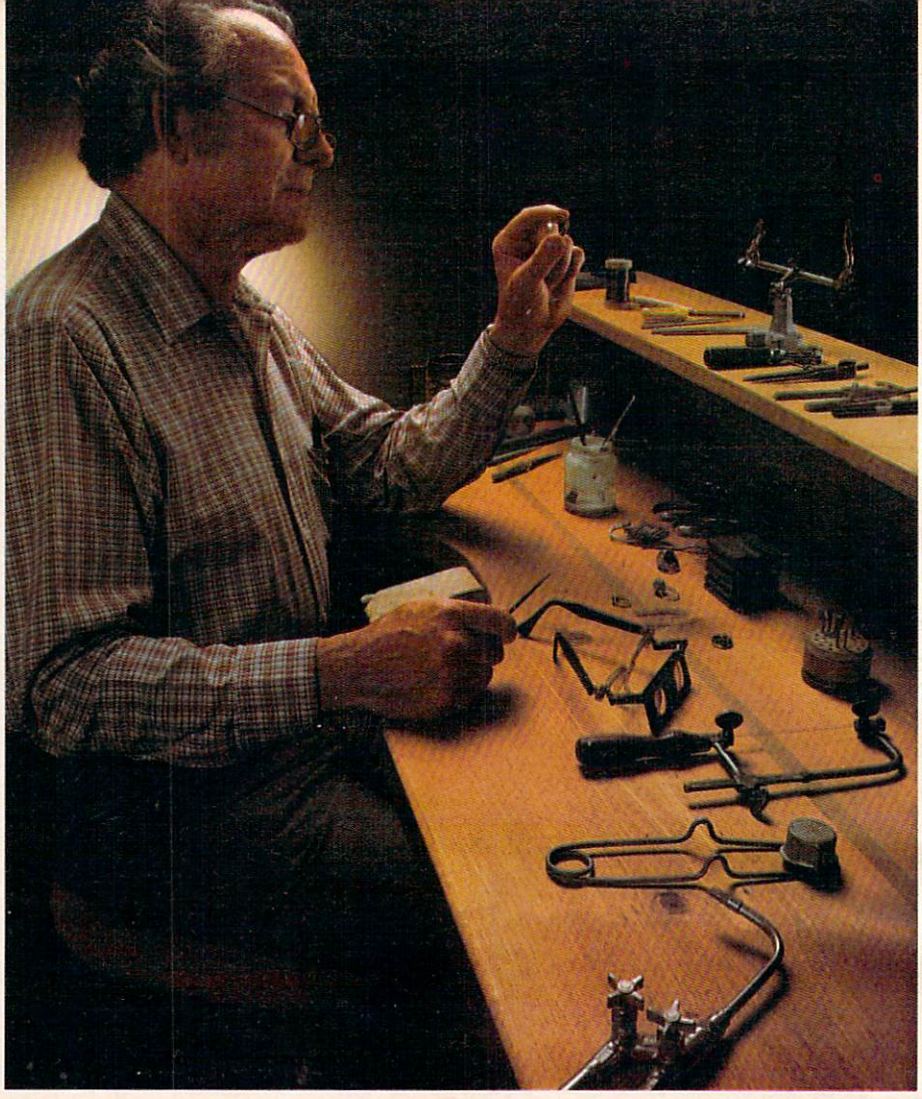

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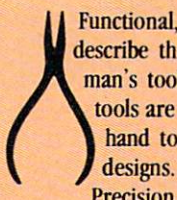

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```
    DDR-BEG+I-1,A(I):NEXT I
550 ADDR=ADDR+6:IF ADDR<=FIN THEN 37
    Ø
560 GOTO 710
570 N=Ø:Z=Ø
580 GET #1,A:IF A=155 OR A=44 OR A=3
    2 THEN 670
590 IF A<32 THEN N=-A:RETURN
600 IF A<>126 THEN 630
610 GOSUB 690:IF I=1 AND T=44 THEN N
    =-1:? CHR$(126);:GOTO 690
620 GOTO 570
630 IF A<48 OR A>57 THEN 580
640 ? CHR$(A+RF);:N=N*10+A-48
650 IF N>255 THEN ? CHR$(253);:A=126
    :GOTO 600
660 Z=Z+1:IF Z<3 THEN 580
670 IF Z=Ø THEN ? CHR$(253);:GOTO 57
    Ø
680 ? ",";:RETURN
690 POKE 752,1:FOR I=1 TO 3:? CHR$(3
    Ø);:GET #6,T:IF T<>44 AND T<>58
    THEN ? CHR$(A);:NEXT I
700 POKE 752,Ø:? " ";CHR$(126);:RETU
    RN
710 GRAPHICS Ø:POKE 710,26:POKE 712,
    26:POKE 709,2
720 IF MEDIA=ASC("T") THEN 890
730 REM  DISK
740 IF READ THEN ? :? "Load File":?
750 IF DTYPE<>ASC("F") THEN 1040
760 ? :? "Enter AUTORUN.SYS for auto
    matic use":? :? "Enter filename"
    :INPUT T$
770 F$=T$:IF LEN(T$)>2 THEN IF T$(1,
    2)<>"D:" THEN F$="D:":F$(3)=T$
780 TRAP 870:CLOSE #2:OPEN #2,8-4*RE
    AD,Ø,F$:? :? "Working..."
790 IF READ THEN FOR I=1 TO 6:GET #2
    ,A:NEXT I:GOTO 820
800 PUT #2,255:PUT #2,255
810 H=INT(BEG/256):L=BEG-H*256:PUT #
    2,L:PUT #2,H:H=INT(FIN/256):L=FI
    N-H*256:PUT #2,L:PUT #2,H
820 GOSUB 970:IF PEEK(195)>1 THEN 87
    Ø
830 IF STARTADR=Ø OR READ THEN 850
840 PUT #2,224:PUT #2,2:PUT #2,225:P
    UT #2,2:H=INT(STARTADR/256):L=ST
    ARTADR-H*256:PUT #2,L:PUT #2,H
850 TRAP 32767:CLOSE #2:? "Finished.
    ":IF READ THEN ? :? :LET READ=Ø:
    GOTO 360
860 END
870 ? "Error ";PEEK(195);" trying to
     access":? F$:CLOSE #2:? :GOTO 7
    60.
880 REM  BOOT TAPE
890 IF READ THEN ? :? "Read Tape"
900 ? :? :? "Insert, Rewind Tape.":?
     "Press PLAY ";:IF  NOT READ THE
    N ? "& RECORD"
910 ? :? "Press  RETURN  when ready:";
920 TRAP 960:CLOSE #2:OPEN #2,8-4*RE
    AD,128,"C:":? :? "Working..."
930 GOSUB 970:IF PEEK(195)>1 THEN 96
    Ø
940 CLOSE #2:TRAP 32767:? "Finished.
    ":? :? :IF READ THEN LET READ=Ø:
    GOTO 360
950 END
960 ? :? "Error ";PEEK(195);" when r
    eading/writing boot tape":? :CLO
    SE #2:GOTO 890
970 REM  CIO Load/Save File#2 opened
     READ=Ø for write, READ=1 for re
    ad
980 X=32:REM File#2,$2Ø
990 ICCOM=834:ICBADR=836:ICBLEN=84Ø:
    ICSTAT=835
1000 H=INT(ADR(BUFFER$)/256):L=ADR(B
    UFFER$)-H*256:POKE ICBADR+X,L:P
    OKE ICBADR+X+1,H
1010 L=FIN-BEG+1:H=INT(L/256):L=L-H*
    256:POKE ICBLEN+X,L:POKE ICBLEN
    +X+1,H
1020 POKE ICCOM+X,11-4*READ:A=USR(AD
    R(CIO$),X)
1030 POKE 195,PEEK(ICSTAT):RETURN
1040 REM  SECTOR I/O
1050 IF READ THEN 1100
1060 ? :? "Format Disk In Drive 1? (
    Y/N):";
1070 GET #1,A:IF A<>78 AND A<>89 THE
    N 1070
1080 ? CHR$(A):IF A=78 THEN 1100
1090 ? :? "Formatting...":XIO 254,#2
    ,Ø,Ø,"D:":? "Format Complete":?

1100 NR=INT((FIN-BEG+127)/128):BUFFE
    R$(FIN-BEG+2)=CHR$(Ø):IF READ T
    HEN ? "Reading...":GOTO 1120
1110 ? "Writing..."
1120 FOR I=1 TO NR:S=I
1130 IF READ THEN GOSUB 1220:BUFFER$
    (I*128-127)=SECTOR$:GOTO 1160
1140 SECTOR$=BUFFER$(I*128-127)
1150 GOSUB 1220
1160 IF PEEK(DSTATS)<>1 THEN 1200
1170 NEXT I
1180 IF  NOT READ THEN END
1190 ? :? :LET READ=Ø:GOTO 360
1200 ? "Error on disk access.":? "Ma
    y need formatting.":GOTO 1040
1210 REM
1220 REM  SECTOR ACCESS SUBROUTINE
1230 REM Drive ONE
1240 REM Pass buffer in SECTOR$
1250 REM sector # in variable S
1260 REM READ=1 for read,
1270 REM READ=Ø for write
1280 BASE=3*256
1290 DUNIT=BASE+1:DCOMND=BASE+2:DSTA
    TS=BASE+3
1300 DBUFLO=BASE+4:DBUFHI=BASE+5
1310 DBYTLO=BASE+8:DBYTHI=BASE+9
1320 DAUX1=BASE+10:DAUX2=BASE+11
1330 REM DIM DSKINV$(4)
1340 DSKINV$="hLS":DSKINV$(4)=CHR$(2
    28)
1350 POKE DUNIT,1:A=ADR(SECTOR$):H=I
    NT(A/256):L=A-256*H
1360 POKE DBUFHI,H
1370 POKE DBUFLO,L
1380 POKE DCOMND,87-5*READ
1390 POKE DAUX2,INT(S/256):POKE DAUX
    1,S-PEEK(DAUX2)*256
1400 A=USR(ADR(DSKINV$))
1410 RETURN
```

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List And Scroll For The VIC And 64

Tom Forsythe

This utility program — an excellent tool for debugging BASIC programs — separates a BASIC listing into single statements, and sets off FOR-NEXT loops and IF-THEN statements for readability. You can also scroll in either direction to scan the listing.

Are you tired of typing LIST or trying to read BASIC statements that are lumped together on the same line? This machine language program allows listing and scrolling of BASIC statements. It prints each statement on a separate line and provides indents during FOR-NEXT loops and after IF-THEN statements, making your BASIC listing more readable.

For example, a normal screen listing looks like this on a VIC:

```
10 A=10:FORJ=1TO4:FORI
=0TO10:PRINTI;:PRINTA*
B:NEXTI:PRINT"PASS "J"
OK":B=A+B:NEXTJ:IFJ=AT
HENA=B:GOTO5:END
```

With "List And Scroll' it would look like this:

```
10
   A=10:
   FORJ=1TO4:
      FORI=0TO10:
         PRINTI;:
         PRINTA*B:
         NEXTI:
      PRINT"PASS "J"OK":
      B=A+B:
      NEXTJ:
   IFJ=ATHENA=B:
      GOTO5:
      END
```

Simple Operation

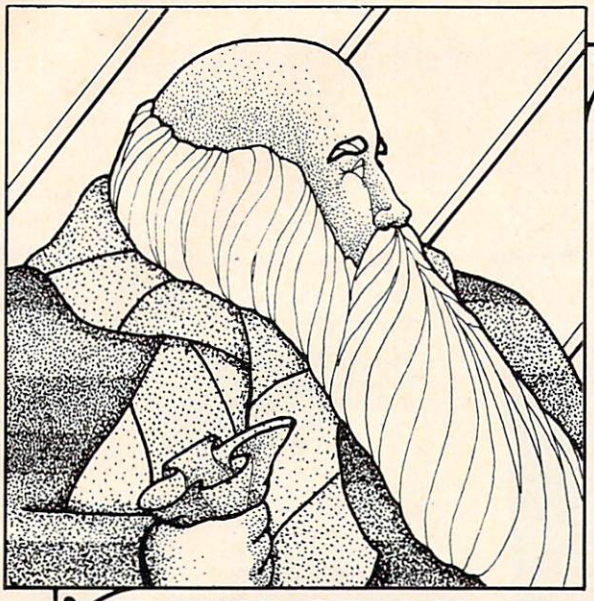
Operation is easier and faster than the normal LIST; just type a period (.) followed by an optional line number. Without the line number, the listing will begin with the first line of your BASIC program. To scroll forward or backward through the listing, use the cursor up or down keys. Pressing the RETURN key or scrolling past either end of the BASIC program will automatically return control to BASIC. You'll know this by the presence of a flashing cursor.

After typing in Program 1 (VIC version) or Program 2 (64 version), be sure to SAVE it to tape or disk. Then you must do one of the following: Type SYS 6769 or type in, SAVE, and RUN Program 3. The first option is fine if the BASIC program you'd like to examine with List And Scroll is not more than 2K (2673 bytes) for the VIC, or 4K (4021 bytes) for the 64. However, you must use Program 3 if your BASIC program exceeds the limits mentioned above.

If you SYS 6769 and your BASIC program is too long, it will write over List And Scroll and render it useless. So, if in doubt, use Program 3. After you type RUN, there will be a short wait and then you'll see a command to SYS to a specified address. Program 3 moves the program to a safe location at the top of memory. VIC users should remove the Super Expander cartridge before using Program 3.

Program 1: List And Scroll (VIC Version)

```
10 I=6768
20 READ A:IF A=256 THEN 40
30 POKE I,A:CK=CK+A:I=I+1:GOTO 20
40 IFCK<>51983THENPRINT"{CLR}ERROR IN DAT
   A STATEMENTS":END
50 END
6768 DATA 1,113,26,173,113,26,133
6776 DATA 55,133,51,173,114,26,133
6784 DATA 56,133,52,234,234,234,169
6792 DATA 76,133,124,173,147,26,133
```



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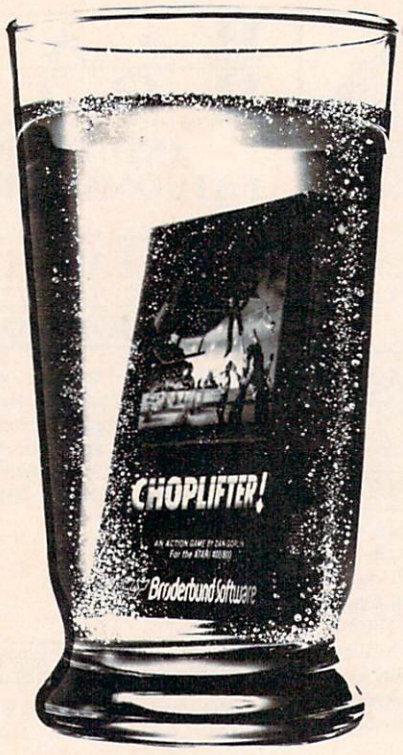

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```
6800 DATA 125,173,148,26,133,126,96
6808 DATA 149,26,201,46,208,9,72
6816 DATA 173,122,0,201,0,240,9
6824 DATA 104,201,58,144,1,96,76
6832 DATA 128,0,169,2,141,251,0
6840 DATA 32,115,0,240,14,176,21
6848 DATA 32,107,201,32,209,26,32
6856 DATA 215,202,76,42,197,169,0
6864 DATA 133,20,133,21,24,144,238
6872 DATA 76,8,207,234,234,234,32
6880 DATA 19,198,160,2,177,95,133
6888 DATA 20,200,177,95,133,21,160
6896 DATA 0,177,95,201,0,208,47
6904 DATA 200,177,95,201,0,208,40
6912 DATA 240,69,169,0,197,20,208
6920 DATA 6,197,21,240,59,198,21
6928 DATA 198,20,32,19,198,160,2
6936 DATA 177,95,197,20,208,231,200
6944 DATA 177,95,197,21,208,224,32
6952 DATA 95,229,24,144,201,32,93
6960 DATA 27,32,228,255,201,0,240
6968 DATA 249,201,145,240,204,201,80
6976 DATA 234,234,234,201,13,240,8
6984 DATA 230,20,208,160,230,21,208
6992 DATA 156,96,56,233,127,170,132
7000 DATA 73,160,255,202,240,8,200
7008 DATA 185,158,192,16,250,48,245
7016 DATA 200,185,158,192,48,6,32
7024 DATA 210,255,208,245,96,164,73
7032 DATA 41,127,32,210,255,96,160
7040 DATA 2,32,215,202,230,199,177
7048 DATA 95,170,200,177,95,32,205
7056 DATA 221,198,199,32,215,202,166
7064 DATA 251,32,228,27,169,0,133
7072 DATA 253,160,3,200,177,95,201
7080 DATA 0,240,83,166,253,208,4
7088 DATA 201,128,176,27,32,210,255
7096 DATA 201,34,208,8,72,165,253
7104 DATA 73,1,133,253,104,201,58
7112 DATA 240,38,208,220,234,234,234
7120 DATA 234,234,234,201,130,208,6
7128 DATA 206,251,0,206,251,0,72
7136 DATA 32,54,27,104,201,129,240
7144 DATA 36,201,167,208,191,230,252
7152 DATA 230,252,24,144,184,32,215
7160 DATA 202,169,0,133,253,165,251
7168 DATA 101,252,170,32,228,27,24
7176 DATA 144,166,169,0,133,252,133
7184 DATA 253,96,230,251,230,251,208
7192 DATA 153,224,0,240,7,32,63
7200 DATA 203,202,24,144,245,96,217,256
```

Program 2: List And Scroll (64 Version)

```
10 I=6769
20 READ A:IF A=256 THEN 40
30 POKE I,A:CK=CK+A:I=I+1:GOTO 20
40 IF CK<>51322THENPRINT"{CLR}ERROR IN DA
   TA STATEMENTS":END
6769 DATA 113,26,173,113,26,133,55
6777 DATA 133,51,173,114,26,133,56
6785 DATA 133,52,234,234,234,169,76
6793 DATA 133,124,173,147,26,133,125
6801 DATA 173,148,26,133,126,96,149
6809 DATA 26,201,46,208,9,72,173
6817 DATA 122,0,201,0,240,9,104
6825 DATA 201,58,144,1,96,76,128
6833 DATA 0,169,2,141,251,0,32
6841 DATA 115,0,240,14,176,21,32
6849 DATA 107,169,32,209,26,32,215
6857 DATA 170,76,42,165,169,0,133
6865 DATA 20,133,21,24,144,238,76
6873 DATA 8,175,234,234,234,32,19
6881 DATA 166,160,2,177,95,133,20
6889 DATA 200,177,95,133,21,160,0
6897 DATA 177,95,201,0,208,47,200
6905 DATA 177,95,201,0,208,40,240
6913 DATA 69,169,0,197,20,208,6
6921 DATA 197,21,240,59,198,21,198
6929 DATA 20,32,19,166,160,2,177
6937 DATA 95,197,20,208,231,200,177
6945 DATA 95,197,21,208,224,32,68
6953 DATA 229,24,144,201,32,93,27
6961 DATA 32,228,255,201,0,240,249
6969 DATA 201,145,240,204,201,80,234
6977 DATA 234,234,201,13,240,8,230
6985 DATA 20,208,160,230,21,208,156
6993 DATA 96,56,233,127,170,132,73
7001 DATA 160,255,202,240,8,200,185
7009 DATA 158,160,16,250,48,245,200
7017 DATA 185,158,160,48,6,32,210
7025 DATA 255,208,245,96,164,73,41
7033 DATA 127,32,210,255,96,160,2
7041 DATA 32,215,170,230,199,177,95
7049 DATA 170,200,177,95,32,205,189
7057 DATA 198,199,32,215,170,166,251
7065 DATA 32,228,27,169,0,133,253
7073 DATA 160,3,200,177,95,201,0
7081 DATA 240,83,166,253,208,4,201
7089 DATA 128,176,27,32,210,255,201
7097 DATA 34,208,8,72,165,253,73
7105 DATA 1,133,253,104,201,58,240
7113 DATA 38,208,220,234,234,234,234
7121 DATA 234,234,201,130,208,6,206
7129 DATA 251,0,206,251,0,72,32
7137 DATA 54,27,104,201,129,240,36
7145 DATA 201,167,208,191,230,252,230
7153 DATA 252,24,144,184,32,215,170
7161 DATA 169,0,133,253,165,251,101
7169 DATA 252,170,32,228,27,24,144
7177 DATA 166,169,0,133,252,133,253
7185 DATA 96,230,251,230,251,208,153
7193 DATA 224,0,240,7,32,63,171
7201 DATA 202,24,144,245,96,256
```

Program 3: Relocater (VIC or 64)

```
10 REM MOVE 'EZLIST/SCROLL TO MEMORY TOP.
20 :
30 LB=6769:REM PROGRAM ADDRESS IN LO MEMO
   RY
40 :
50 HB=PEEK(56)*256+PEEK(55)-399:REM PROGRA
   M ADDRESS IN HI MEMORY
60 :
70 REM MOVE BIT BY BIT
80 READA: REM LOC TO CORRECT
100 FORI=0TO382
103 POKEHB+I,PEEK(LB+I)
105 IFA<>LB+IGOTO170
110 V=PEEK(A)+PEEK(A+1)*256:A=V+HB-LB
120 POKEHB+I,A-INT(A/256)*256:I=I+1:POKEH
    B+I,INT(A/256):READA
170 NEXT
180 PRINT"{CLR}TO ENABLE EZ-LISTER
    {3 SPACES}TYPE SYS"HB+2
190 END
195 REM OFFSET VALUES
200 DATA6769,6772,6779,6793,6798,6803
210 DATA6842,6935,7029,7091,7122,0
```

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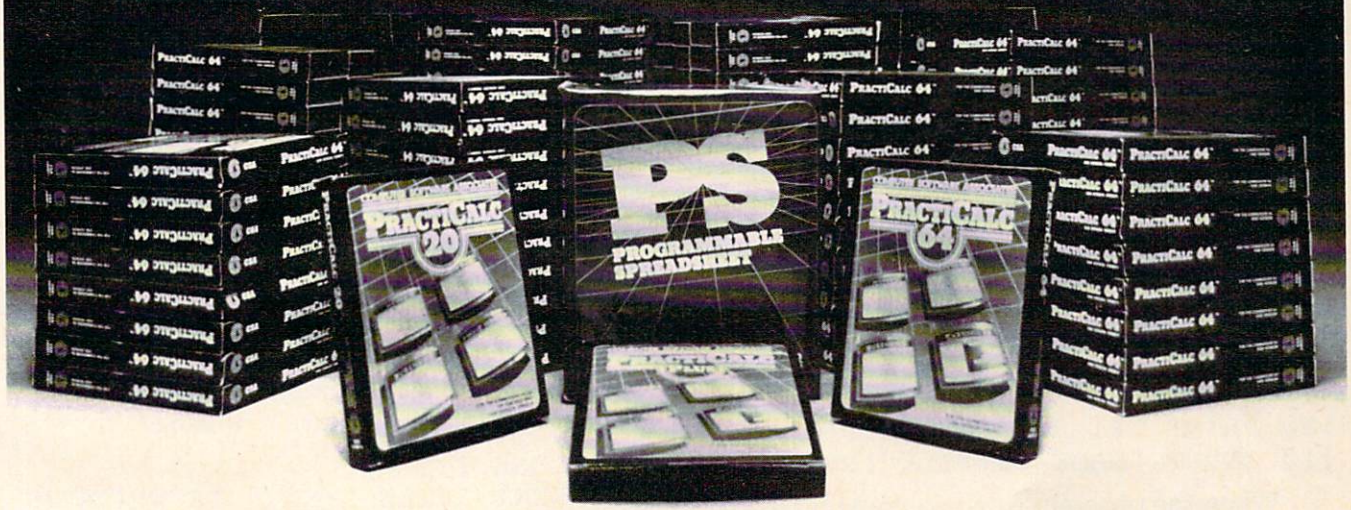

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Commodore Files For Beginners

Part 2

Jim Butterfield, Associate Editor

Expanding on his program examples from last month, Associate Editor Jim Butterfield suggests ways to improve and safeguard your files. For disk and tape users.

Creating A File By Program

We can repeat the file creation that we performed last month with direct statements, but this time we'll do it in a more typical way: as part of a program. Here come the statements we have seen before, with a few small enhancements:

```
100 PRINT "FILE CREATION"
110 INPUT "NAME OF FILE";N$
```

When the program runs, we must type in a file name. This might be the same name we used previously (STUDENTS). It's wise to choose a name that hasn't been used before. In fact, with disk it's mandatory: we cannot have two files with exactly the same name on one disk.

Now for the OPEN statement. For disk, we type:

```
120 OPEN 1,8,2,"0:"+N$+",S,W"
```

For tape, we make line 120 read:

```
120 OPEN 1,1,2,N$
```

Now to write the data. Since we're writing a generalized program, it might be wise to ask the user to input the data. As soon as it is received, we'll write it to the file:

```
130 INPUT "NAME";A$
140 INPUT "STUDENT NUMBER";B$
150 INPUT "MARK";M
160 REM PRINT IT
170 PRINT#1,A$;CHR$(13);
180 PRINT#1,B$;CHR$(13);
190 PRINT#1,M;CHR$(13);
```

We could make the program more friendly by asking ARE YOU SURE? in line 155, so that the user could reenter the information if a mistake had occurred.

Now that the record is written, we need to ask if there are any more:

```
200 PRINT
210 INPUT "MORE";X$
220 IF X$="Y" OR X$="YES" GOTO 130
```

When we get beyond this point, the user has signaled that the job is completed. All we need to do is CLOSE the file, and we're finished:

```
230 CLOSE 1
240 PRINT "FILE ";N$;" IS WRITTEN"
```

Trimmings For Disk

If we are using disk, we might add disk error checking. This tells us if we have problems — it's especially important at the time of opening the file. The extra lines for this would be added to the above program:

```
90 OPEN 15,8,15
95 PRINT#15,"I0"
125 INPUT#15,E,E$,E1,E2
126 IF E THEN PRINT E$:STOP
```

Lines 125 and 126 may be repeated after each disk activity, so we could see the same instructions at lines 205 and 206, and again at 235 and 236. You could put these two lines in a subroutine, but they are brief enough to repeat at the appropriate places. Finally, we should CLOSE the command channel with:

```
250 CLOSE 15
```

Always OPEN the command channel at the beginning of a program and CLOSE it at the end. Closing a command channel causes the disk to close any other channels it might have going; it

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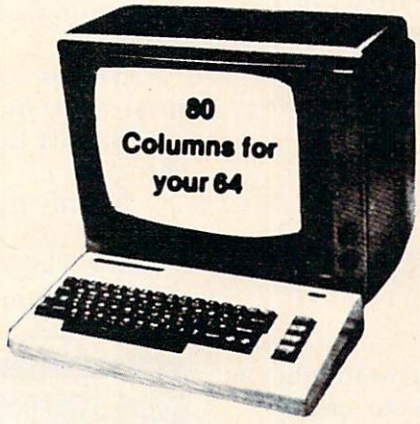

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could give you real trouble if performed too early.

Trimmings For Tape

You *could* remove the ;CHR$(13); ending from the PRINT#1 lines if you wish. But it might be best to leave it in place, so that your programs can be converted to disk operation without fuss.

If you have an original small-keyboard PET, you can't write to disk at all and may have trouble with cassette tape (blocks written too closely together). If you're serious about files, you might want to upgrade your machine.

A cassette tape file doesn't need to have a name, but use one anyway.

Reading It Back

It would be nice to bring the file back using direct statements, as we did the first time we wrote the information. However, we can't use INPUT# in direct mode, so we must write a program. Much of it will look familiar. First, we OPEN the file, then ask for the name:

```
100 PRINT "FILE READER"
110 INPUT "FILE NAME";N$
```

For disk, we would write the OPEN statement as:

```
120 OPEN 1,8,2,N$
```

We don't need to specify the drive number as both will be checked. We don't need to specify ,S,R for sequential read because these options will be assumed. It doesn't hurt to specify everything, however.

For tape, we would OPEN with:

```
120 OPEN 1,1,0,N$
```

In fact, if there's only one data file on the tape, or if the one we want is the first, we could write OPEN 1 and everything else would be assumed.

```
130 INPUT#1,A$
140 INPUT#1,B$
150 INPUT#1,M
```

Now that we've input a record, let's print it out:

```
160 PRINT "NAME:{3 SPACES}";A$
170 PRINT "NUMBER: ";B$
180 PRINT "MARK:{3 SPACES}";M
```

Are there any more records? The computer knows; and if we know how, we can ask the computer.

There's a variable in the computer called ST or STATUS. After every file operation — or more exactly, after every input/output operation — variable ST will be set as follows:

ST equals 0: file OK, more to come
ST equals 64: file OK, no more to come
ST other than 0 or 64: file has a problem

For our simple reading program, we can type:

```
190 IF ST=0 GOTO 130
```

Thus, if the file is OK and is not at the end, we'll go back and get another record.

Finally, we CLOSE the file with:

```
200 CLOSE 1
```

RUN the above program, and the information we wrote to file STUDENTS will be recalled and printed out to the screen.

Try Your Hand At These

Our file program is a good working example. You might like to see if you can write some of the following variations:

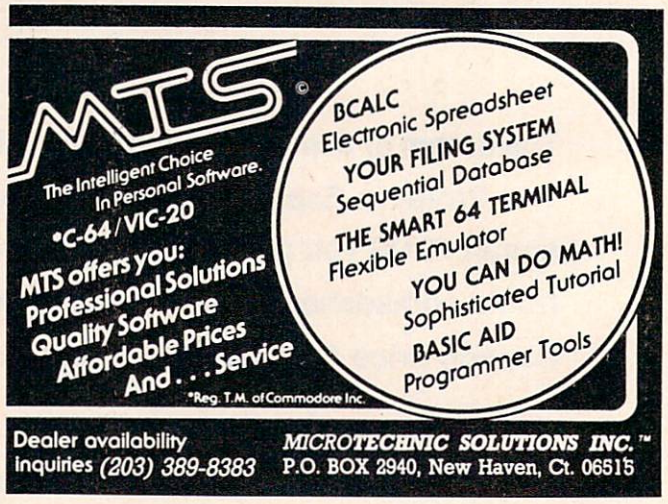
If you have disk, add error checking. Then try creating errors (bad names) and see what happens.

Modify the program to print only student records for students named JONES.

Modify the program to count the number of students.

Modify the program to calculate an average grade.

We'll look at other aspects of sequential files next time around. ©



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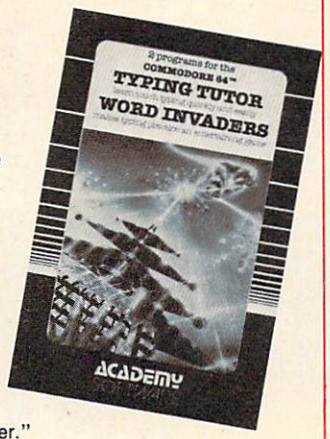

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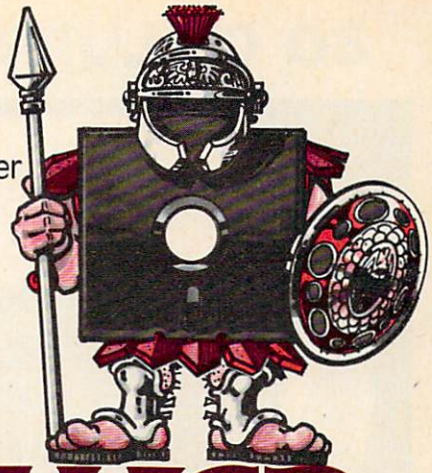

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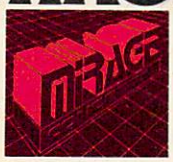

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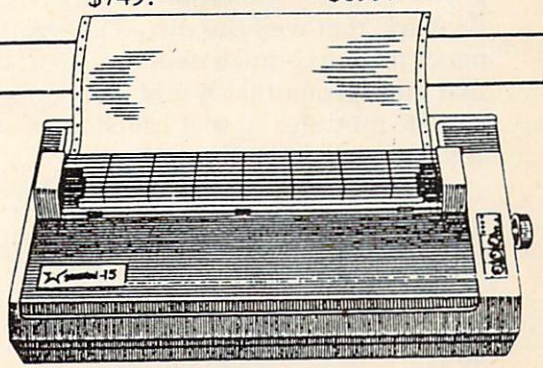

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Jim Butterfield, Associate Editor

Hopping Around

Transfer of control — jumping and branching — seems to be easy and straightforward to accomplish. In 6502 programming, you can make a decision-based branch, which will take you forward or backward a hundred-odd locations; or an unconditional jump, which will take you anywhere you want to go.

Yet there are a number of techniques that transfer control in unusual ways. Often they may seem like tricks, but they can be useful in achieving programming objectives: speed, flexibility, or compactness. We'll look at some of these techniques here.

The Long Branch

If you want to use a branch to implement a decision, your range is limited to slightly over 120 locations forward or backward. We often want to get around this limitation. It may be argued, by the way, that well-organized programs should never need to branch over any great distance; that your programs should be organized into subroutine modules so that transfers of control will always be short and visible.

For the moment, let's look at an example:

```
2000            LDX  #$20
2002  BIGLOOP   LDA  #$0D
....
....
20C0            DEX
20C1            BNE  BIGLOOP
20C3            ...
```

We have a problem here. We can't branch over the needed range — about 190 bytes. The simple way is to insert a JMP:

```
20C0            DEX
20C1            BEQ  SKIP
20C3            JMP  BIGLOOP
20C6  SKIP      ...
```

Another way is more subtle and must be used with care. It avoids the JMP, and thus makes a routine more easily relocatable. Let's assume that somewhere in our program sequence we have a BNE:

```
2000            LDX  #$20
2002  BIGLOOP   LDA  #$0D
....
....
2065            LDA  $027A
2068            BNE  STEP
```

Now, immediately after the BNE at address 2068, another BNE instruction would never branch. After all, if the Z flag is clear, we will take the previous branch to STEP. And if the Z flag is set, neither branch will be taken. So we might use:

```
2000            LDX  #$20
2002  BIGLOOP   LDA  #$0D
....
....
2065            LDA  $027A
2068            BNE  STEP
206A  LINK      BNE  BIGLOOP
....
....
20C2            DEX
20C3            BNE  LINK
```

As the program executes in the area of 2065, it will never take the branch to BIGLOOP. But when we get down to the bottom, the instruction at 20C3 will (if conditions are right) branch to LINK, and will immediately branch again to BIGLOOP. Each branch is now a shorter hop and easily within range.

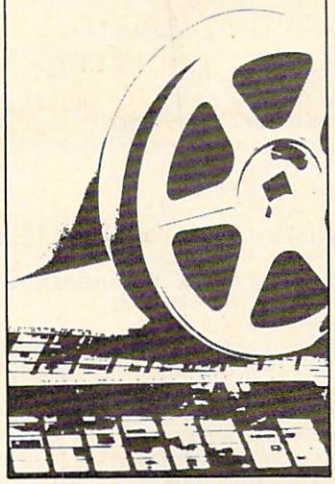
Hidden Instructions

Suppose you need a series of PRINT subroutines, one to print a RETURN ($0D), one to print a space ($20), and another to print an exclamation point. You could write three subroutines; or you could write the three Load commands and then branch to a common point; or you could do this:

```
2000  A9 0D     LDA  #$0D      ;return
2002  2C A9 20  BIT  $20A9     ;hidden space
2005  2C A9 3F  BIT  $3FA9     ;hidden question mark
2008  20 D2 FF  JSR  PRINT     ;print it
200B  60        RTS            ;return
```

What happens when we call address 2000? We load the RETURN character, perform two

This Publication is available in Microform.



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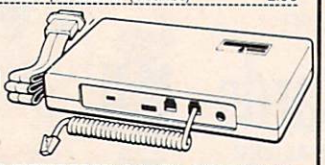

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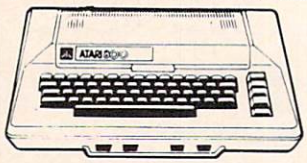

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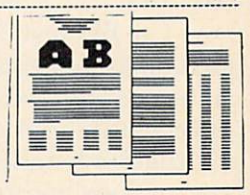

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meaningless BIT tests — they set the status flags, but we never test them — and then print RETURN.

But, what happens if we JSR to 2003? That's not an instruction — wait — yes, it is. It's A9 20, which is the same as LDA #$20. So we load the A register with a space character, do one meaningless BIT instruction, and print it. And if we JSR to 2006, we'll load A with $3F, the question mark, and print that.

What's happening here? By inserting the byte 2C ahead of the two extra A9 or LDA commands, we have made them "invisible." We can slide right through them, without needing to jump over them.

The BIT test, $2C, is ideal since it does not affect memory or any registers other than the status register, which we don't need. Some computers have a series of NOP commands of various instruction lengths, which are useful for "hiding" instructions within the address field. Sometimes these instructions have names other than NOP – for example, "Branch Never" or "Rotate 0 Bits" — but you get the idea.

The Invisible Return

Our last example ended with a JSR and RTS. Think about this. We will call a subroutine; it will return to us; and then we will return to the routine that called us. The return addresses are kept on the stack, of course. Suppose we just JMP to the subroutine. When the subroutine is ready to return, it will go directly to the routine that called our program. Thus, with rare exceptions, JSR and RTS are identical to JMP. We've saved a byte and a little time.

Programmers working with limited memory find this kind of tightening up useful, and it often leads to further economies. For example, if there's a routine called DOG and one called CAT; and if DOG ends with JSR CAT:RTS; then the first step is to replace this with JMP CAT. Now, we won't need to jump to CAT if that subroutine immediately follows. Instead of jumping there, we'll just fall into it. Suddenly, two subroutines have become one — with two entry points.

There's another interesting use for this technique. Suppose you've written a subroutine SPC to print a space, and now you want to write a subroutine to print two spaces. You might start with the sequence JSR SPC:JSR SPC:RTS — but a little boiling down will generate the sequence:

```
SPC2    JSR  SPC
SPC     LDA  #$20
        JMP  PRINT
```

It seems odd to see a subroutine that starts out by calling the following instruction as a subroutine. But if you think of the way subroutines work, you'll see that it does a simple job: it executes the subroutine twice.

By the way, some theorists are very strong on the idea that all subroutines should have one entry point and one clearly defined exit. You'll have to decide on your own style. If you have lots of memory and processing time, you might prefer neatness. On the other hand, if you're trying to crowd a lot of programming into a small 2K ROM, you'll take all the economies you can get. ©

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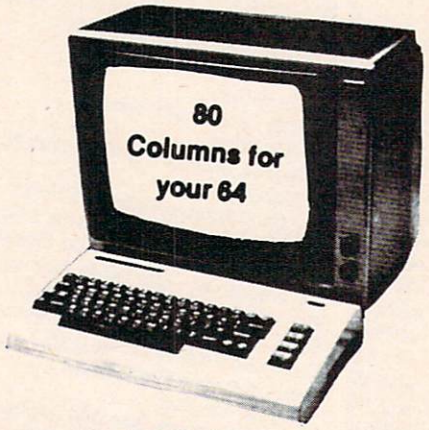

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Computer Fun

The best news for TI owners this Christmas season is that Texas Instruments has reduced the price of its peripherals. One complaint about the TI-99/4A has been that the cost of the basic computer was quite reasonable, but if you wanted to add disk drives or a printer, the cost was out of sight. But that's not a valid complaint anymore. The peripheral expansion box with one disk drive, the disk controller card, and the 32K memory expansion card now have a total list price of $550 — I have seen advertisements of prices near $450.

The RS-232 interface card, needed to add a printer or a modem, lists for around $100. Therefore, since the computer itself sells for about $100, you can get a "complete system" for under $700. Although you can use other brands of printers and modems, the TI printer has been reduced to $500, and the TI modem to $100. All of this means that more TI owners will be getting the peripherals and discovering even more ways we can use our computers in our homes.

Computer Choreography

Since December is a festive time of year, the subject of this column is combining music with graphics to create a show I call "computer choreography." Two months ago I wrote about music on the TI-99/4A. This column is a continuation of that topic, with an explanation of one way to add graphics to the music. Remember, there are many ways to program — there's no *one* "correct" way. Your program is "correct" if it works the way you want it to when you run it. If it runs properly, you are successful.

Many programming books tell you to plan your program carefully by sketching a structure chart or writing different sections of coding. High school teachers often have students write out the program by hand before going to the computer. (Actually, often the real reason for this procedure is that the school doesn't have enough computers for the whole class.) If you are using a terminal or a mainframe computer and need to pay for computer time, you do need to plan carefully for efficiency. A home computer allows you to experiment to your heart's content — and even try out your program after every few lines if you wish. Although I usually do sketch out my graphics on graph paper, most of my programming is done by composing right at the console.

Choreography programs require a lot of experimentation, so it is almost better to compose at the console rather than plan each statement in order. Let's get right to an example. I chose a Christmas song that I would like to "play" on the computer. I looked up the music in a songbook then started translating notes. Each CALL SOUND statement contains a duration, a melody note and volume, and two accompaniment notes with their volumes. The duration is expressed in terms of a variable T, which is defined at the beginning of the program.

```
100 REM  SILENT NIGHT
110 T=400
120 CALL SOUND(T*1.5,392,4,330,8,13
    1,10)
130 CALL SOUND(T/2,440,4,349,8,131,
    10)
140 CALL SOUND(T,392,4,330,8,131,9)
150 CALL SOUND(3*T,330,4,262,6,196,
    9)
160 CALL SOUND(T*1.5,392,4,330,8,13
    1,10)
170 CALL SOUND(T/2,440,4,349,8,131,
    10)
180 CALL SOUND(T,392,4,330,8,131,9)
190 CALL SOUND(3*T,330,4,262,6,196,
    9)
200 CALL SOUND(2*T,587,2,349,4,247,
    8)
210 CALL SOUND(T,587,3,349,5,247,9)
220 CALL SOUND(3*T,494,3,294,6,196,
    9)
```

Try different values for T in line 110. For example, try T=600. Then try T=100. By programming the duration in terms of T, you only need to change line 110, not each of the CALL SOUND statements, to increase or decrease the speed of the song. Keep experimenting until you find the tempo you like.

You may write the three notes (frequencies) in the CALL SOUND statement in any order you wish. I usually write the melody note first so I can keep track of the tune. Also, if I later run out of memory I can more easily delete some of the accompaniment notes because I know the melody note is the first frequency.

Each frequency has a corresponding volume. I write the melody notes with a louder volume than the accompaniment notes in order to bring out the melody. Also, many times bass notes sound louder to us naturally, so we need to lower their volume.

By the way, our chart's lowest available note is low A on the bass clef (frequency 110), and you cannot use a frequency number less than 110. However, it is possible to get tones lower than low A. Comparing the tones to an electronic keyboard, Jerry Glaze of Las Vegas, Nevada, has come up with various numbers to get lower tones. He suggests you try this command to hear low G:

```
CALL SOUND(2000,1475,30,1475,30,147
5,30,-4,1)
```

He specifies three music frequencies of 1475 with a volume of 30, plus the noise parameter of −4 with a volume of 1. Now change each of the 1475 numbers to 1293 and you'll hear low F (one line below the bass clef). Continuing downward, Jerry suggests the following numbers: 1227 – E; 1105 – D; 990 – C. (You may wish to adjust the numbers slightly.)

Adding Graphics To Music

Now let's add graphics. The actual picture I plan on paper first. I sketch out the main picture on graph paper 24 squares by 32 squares to correspond to the 24 rows by 32 columns on the screen. Any pictures that do not fit into the full squares are redrawn on 8 by 8 squares for the high resolution graphics. Then add line 105 CALL CLEAR to clear the screen before running the program. Now we're ready to begin by inserting graphics commands among the present sound commands.

First, you need to define graphics characters for later pictures using CALL CHAR STATEMENTS. This is where you really need to experiment. Try adding the following lines:

```
122 CALL CHAR(128,"0101010303FF7F1F
    ")
124 CALL CHAR(129,"0F0F1F3E3860C4")
```

Be sure those are zeros and not the letter O in the quotes of the character definitions. Now try running the program. It should sound the same as when you ran it without any graphics statements since the TI can play music while it is executing other commands. Depending on how long a note is held, you can define characters between sounds. In this case we were able to define two characters between the first note and the second. You may be able to define more characters, but if you put too many definitions between the sounds, there will be a gap between the notes — so you need to use fewer definitions or commands.

I stayed with just the two definitions between the first two notes. I decided to put the next definition after the third note. Add:

```
145 CALL CHAR(130,"0080808C0C0FFFEFC
    ")
```

Line 150 is the sound corresponding to the word "night" in the song "Silent Night," so right after the music is played, I change the screen color to black with

```
152 CALL SCREEN(2)
```

This chord has a rather long duration, so let's define two more characters. Add:

```
154 CALL CHAR(131,"F8F0F8F83C0C06")
156 CALL CHAR(132,"0002040810204")
```

Next I started drawing a star. In this case the screen is black and characters are naturally black with a transparent background, so any characters placed on the screen won't be seen until the color is changed. I didn't want the star to actually appear until after "holy night." To make the star, add the following statements:

```
162 CALL HCHAR(3,25,128)
164 CALL HCHAR(4,25,129)
166 CALL HCHAR(3,26,130)
168 CALL HCHAR(4,26,131)
```

and after "night" in line 190,

```
192 CALL COLOR(13,16,1)
```

You can use this technique of drawing invisibly by first defining the colors of the character with a CALL COLOR statement to match whatever colors are already on the screen; then placing the characters on the screen with CALL HCHAR and CALL VCHAR; then making the characters visible with another CALL COLOR statement defining the visible colors.

After you add a few more character definitions and some HCHAR commands to draw on the screen, then RESequence the program segment, this is how it will look.

Program 1: "Silent Night"

```
100 REM  SILENT NIGHT
110 CALL CLEAR
120 T=400
130 CALL SOUND(T*1.5,392,4,330,8,13
    1,10)
```

```
140 CALL CHAR(128,"Ø1Ø1Ø1Ø3Ø3FF7F1F
    ")
150 CALL CHAR(129,"ØFØF1F3E38604")
160 CALL SOUND(T/2,440,4,349,8,131,
    1Ø)
170 CALL SOUND(T,392,4,330,8,131,9)
180 CALL CHAR(130,"ØØ8Ø8ØC0C0FFFEFC
    ")
190 CALL SOUND(3*T,330,4,262,6,196,
    9)
200 CALL SCREEN(2)
210 CALL CHAR(131,"F8FØF8F83C0C06")
220 CALL CHAR(132,"ØØØ2Ø4Ø81Ø2Ø4")
230 CALL SOUND(T*1.5,392,4,330,8,13
    1,1Ø)
240 CALL HCHAR(3,25,128)
250 CALL HCHAR(4,25,129)
260 CALL HCHAR(3,26,130)
270 CALL HCHAR(4,26,131)
280 CALL SOUND(T/2,440,4,349,8,131,
    1Ø)
290 CALL SOUND(T,392,4,330,8,131,9)
300 CALL CHAR(133,"ØØØ2Ø2Ø4Ø4Ø8Ø8")
310 CALL SOUND(3*T,330,4,262,6,196,
    9)
320 CALL COLOR(13,16,1)
330 CALL CHAR(134,"ØØ2Ø2Ø4Ø4Ø8Ø8")
340 CALL SOUND(2*T,587,2,349,4,247,
    8)
350 CALL HCHAR(4,24,132)
360 CALL HCHAR(5,23,132)
370 CALL HCHAR(6,22,132)
380 CALL SOUND(T,587,3,349,5,247,9)
390 CALL SOUND(3*T,494,3,294,6,196,
    9)
400 CALL HCHAR(5,25,133)
410 CALL HCHAR(6,25,134)
420 CALL HCHAR(7,24,133)
430 CALL HCHAR(8,24,134)
440 GOTO 440
```

The last line, 440 GOTO 440, keeps the picture on the screen until you press CLEAR (SHIFT C on the TI-99/4 or FCTN 4 on the TI-99/4A). I'm going to leave the rest of the song up to you. Since I'm not an artist, I often look at children's picture books or coloring books for picture ideas. For Christmas scenes, you can also try tracing Christmas stencils on graph paper then coloring the squares to plan your shapes. Computer choreography can be a lot of fun, and I know many people who have gotten interested in programming by first designing pictures with music.

A New Year's Present

I promised you a Christmas present, but I've decided to make it a New Year's present instead. I got my first computer for Christmas in 1980, and one of the first programs I wrote was the music for "Auld Lang Syne" with the screen showing 1980 turning into 1981. Each year I change the year and I change the graphics or music slightly. In 1981 I had TI Extended BASIC and made the number 1 out of sprites that moved off the screen to make room for 1982. This year I'm using the natural scrolling of PRINT statements to move 1983 off the screen while bringing in the new year.

I'm also including a TI Extended BASIC version (Program 3). To RUN it, you will need the TI Extended BASIC command module. It includes fireworks and champagne bubbles while the music is playing. In the character definitions, up to four characters may be defined in one command. Trailing REMark statements are allowed with the exclamation point, so the words (or syllables) to the music are written along with the CALL SOUND statements.

If you want to use these programs right at midnight, type RUN then press ENTER at 31 seconds before midnight for the regular TI BASIC program, or 25 seconds before midnight for the TI Extended BASIC program. The year 1984 will be in place exactly for the new year.

Have a happy holiday season!

Program 2: "Auld Lang Syne" (TI BASIC)

```
100 REM  AULD LANG SYNE
110 CALL CLEAR
120 CALL SCREEN(4)
130 CALL CHAR(96,"ØØØ1Ø1Ø3Ø3Ø7Ø7ØF"
    )
140 CALL CHAR(97,"ØF1F1F3F3F7F7FFF"
    )
150 CALL CHAR(98,"FFFFFFFFFFFFFFFF"
    )
160 T=6ØØ
170 CALL SOUND(T*1.1,262,5)
180 CALL CHAR(104,"ØØØ3ØF1F3F3F7F7F
    ")
190 CALL CHAR(105,"7F7F3F3F1FØFØ3")
200 CALL CHAR(106,"ØØCØFØF8FCFCFEFE
    ")
210 CALL CHAR(107,"FEFEFCFCF8FØCØ")
220 CALL SOUND(T*1.5,349,5,262,12,1
    75,15)
230 CALL VCHAR(8,5,98,9)
240 CALL VCHAR(8,4,96)
250 CALL VCHAR(9,4,97)
260 CALL SOUND(T/2,349,5,262,12,196
    ,15)
270 CALL SOUND(T,349,4,262,12,220,1
    5)
280 CALL CHAR(108,"7F3F1FØ7ØF1F3F7F
    ")
290 CALL CHAR(109,"FEFCF8CØFØF8FCFE
    ")
300 CALL SOUND(T,440,5,349,12,175,1
    5)
310 CALL HCHAR(8,10,98,3)
320 CALL HCHAR(8,9,104)
330 CALL VCHAR(9,9,98,3)
340 CALL SOUND(T*1.5,392,5,330,12,1
    31,15)
350 CALL HCHAR(12,9,105)
360 CALL HCHAR(12,10,98,3)
370 CALL VCHAR(8,13,106)
380 CALL VCHAR(9,13,98,7)
390 CALL SOUND(T/2,349,5,294,12,131
    ,15)
400 CALL SOUND(T,392,5,330,12,131,1
    5)
410 CALL HCHAR(16,13,107)
420 CALL HCHAR(16,10,98,3)
```

```
430 CALL HCHAR(15,9,98)
440 CALL HCHAR(16,9,105)
450 CALL SOUND(T,440,5,330,12,131,1
    5)
460 CALL HCHAR(8,17,104)
470 CALL HCHAR(8,18,98,3)
480 CALL HCHAR(8,21,106)
490 CALL VCHAR(9,21,98,3)
500 CALL SOUND(T*1.5,349,6,220,12,1
    75,15)
510 CALL VCHAR(9,17,98,3)
520 CALL HCHAR(12,17,108)
530 CALL HCHAR(12,18,98,3)
540 CALL HCHAR(12,21,109)
550 CALL SOUND(T/2,349,6,220,12,175
    ,15)
560 CALL VCHAR(13,17,98,3)
570 CALL SOUND(T,440,4,349,12,175,1
    5)
580 CALL VCHAR(16,17,105)
590 CALL HCHAR(16,18,98,3)
600 CALL HCHAR(16,21,107)
610 CALL SOUND(T,523,3,349,10,175,1
    3)
620 CALL VCHAR(13,21,98,3)
630 CALL HCHAR(9,25,98)
640 CALL HCHAR(8,25,104)
650 CALL SOUND(3*T,587,2,349,8,233,
    10)
660 CALL HCHAR(8,26,98,3)
670 CALL HCHAR(8,29,106)
680 CALL VCHAR(9,29,98,3)
690 CALL HCHAR(12,27,98,2)
700 CALL HCHAR(12,29,109)
710 CALL VCHAR(13,29,98,3)
720 CALL HCHAR(16,29,107)
730 CALL HCHAR(16,26,98,3)
740 CALL HCHAR(16,25,105)
750 CALL HCHAR(15,25,98)
760 CALL SOUND(T,587,2,349,8,233,10
    )
770 CALL SCREEN(8)
780 PRINT " 'b{3 SPACES}hbbbj
    {3 SPACES}hbbbj{3 SPACES}a"
790 CALL SOUND(T*1.5,523,3,349,10,2
    20,13)
800 PRINT " ab{3 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b"
810 CALL SOUND(T/2,440,4,349,12,175
    ,15)
820 PRINT "  b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b"
830 CALL SOUND(T,440,6,349,12,175,1
    5)
840 PRINT "  b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b  b"
850 CALL SOUND(T,349,6,220,12,175,1
    5)
860 PRINT "  b{3 SPACES}ibbbb
    {3 SPACES}lbbbm{3 SPACES}b  b"
870 CALL SOUND(T*1.5,392,6,330,12,1
    31,15)
880 PRINT "  b{7 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {3 SPACES}bbbbb"
890 CALL SOUND(T/2,349,6,294,12,131
    ,15)
900 PRINT "  b{7 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {6 SPACES}b"
910 CALL SOUND(T,392,6,330,12,131,1
    5)
920 PRINT "  b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {3 SPACES}b{6 SPACES}b"
930 CALL SOUND(T,440,6,330,12,131,1
    5)
940 PRINT "  b{3 SPACES}ibbbk
    {3 SPACES}ibbbk{6 SPACES}b"
950 CALL SOUND(T*1.5,349,6,294,12,1
    47,15)
960 PRINT
970 CALL SOUND(T/2,294,7,220,12,147
    ,15)
980 PRINT
990 CALL SOUND(T,294,7,233,12,117,1
    5)
1000 PRINT
1010 CALL SOUND(T,262,8,233,14,131,
     16)
1020 PRINT
1030 CALL SOUND(3*T,349,8,220,15,17
     5,17)
1040 PRINT :::
1050 CALL SOUND(T,587,5,349,12,175,
     15)
1060 CALL COLOR(9,5,1)
1070 CALL COLOR(10,5,1)
1080 CALL COLOR(2,7,1)
1090 CALL SOUND(T*1.5,523,5,349,12,
     175,15)
1100 FOR I=5 TO 25 STEP 5
1110 CALL HCHAR(6,I,42)
1120 NEXT I
1130 CALL SOUND(T/2,440,6,262,15)
1140 CALL SOUND(T,440,6,349,12,175,
     15)
1150 CALL HCHAR(4,13,42)
1160 CALL HCHAR(4,17,42)
1170 CALL HCHAR(2,11,42)
1180 CALL HCHAR(2,19,42)
1190 CALL SOUND(T,349,6,110,18)
1200 CALL HCHAR(4,8,42)
1210 CALL HCHAR(2,6,42)
1220 CALL HCHAR(4,22,42)
1230 CALL HCHAR(2,24,42)
1240 CALL SOUND(T*1.5,392,6,330,14,
     131,16)
1250 FOR I=5 TO 25 STEP 5
1260 CALL HCHAR(18,I,42)
1270 NEXT I
1280 CALL SOUND(T/2,349,6,294,12,13
     1,17)
1290 CALL SCREEN(8)
1300 CALL SOUND(T,392,7,330,15,131,
     17)
1310 CALL HCHAR(20,13,42)
1320 CALL HCHAR(20,17,42)
1330 CALL HCHAR(22,11,42)
1340 CALL HCHAR(22,19,42)
1350 CALL SOUND(T,587,6,330,14,131,
     16)
1360 CALL HCHAR(20,8,42)
1370 CALL HCHAR(22,6,42)
1380 CALL HCHAR(20,22,42)
1390 CALL HCHAR(22,24,42)
1400 CALL SOUND(T*1.5,262,6,349,14,
```

```
      131,16)
1410 CALL HCHAR(4,3,42)
1420 CALL HCHAR(2,1,42)
1430 CALL HCHAR(4,27,42)
1440 CALL HCHAR(2,29,42)
1450 CALL COLOR(9,7,1)
1460 CALL COLOR(10,7,1)
1470 CALL SOUND(T/2,440,7,131,16)
1480 CALL SOUND(T,440,6,349,14,175,
      16)
1490 CALL HCHAR(20,3,42)
1500 CALL HCHAR(22,1,42)
1510 CALL HCHAR(20,27,42)
1520 CALL HCHAR(22,29,42)
1530 CALL SOUND(T,523,5,220,15)
1540 CALL SOUND(3*T,587,3,349,12,23
      3,14)
1550 CALL COLOR(2,16,1)
1560 CALL SOUND(T,698,2,349,13,233,
      15)
1570 CALL COLOR(2,12,1)
1580 CALL SOUND(T*1.5,523,3,349,12,
      220,14)
1590 CALL COLOR(9,11,1)
1600 CALL COLOR(10,11,1)
1610 CALL SOUND(T/2,440,4,349,13,17
      5,15)
1620 CALL SOUND(T,440,4,349,13,175,
      15)
1630 CALL COLOR(2,5,1)
1640 CALL SOUND(T,349,5,262,13,110,
      15)
1650 CALL COLOR(2,16,1)
1660 CALL SOUND(T*1.5,392,5,330,13,
      131,15)
1670 CALL COLOR(9,14,1)
1680 CALL COLOR(10,14,1)
1690 CALL COLOR(2,7,1)
1700 CALL SOUND(T/2,349,5,294,13,13
      1,15)
1710 CALL COLOR(2,16,1)
1720 CALL SOUND(T,392,5,330,12,131,
      15)
1730 CALL COLOR(2,12,1)
1740 CALL SOUND(T/2,440,5,330,13,13
      9,15)
1750 CALL COLOR(2,16,1)
1760 CALL SOUND(T/2,392,5,330,13,13
      9,15)
1770 CALL COLOR(2,3,1)
1780 CALL SOUND(T*1.5,349,5,294,14,
      147,16)
1790 CALL COLOR(9,16,1)
1800 CALL COLOR(10,16,1)
1810 CALL COLOR(2,16,1)
1820 CALL SOUND(T/2,294,6,220,14,17
      5,16)
1830 CALL COLOR(2,6,1)
1840 CALL SOUND(T,294,7,233,15,117,
      17)
1850 CALL COLOR(2,14,1)
1860 CALL SCREEN(11)
1870 CALL SOUND(T,262,7,165,15,131,
      17)
1880 CALL COLOR(2,12,1)
1890 CALL SOUND(4*T,349,6,220,15,17
      5,17)
1900 CALL SCREEN(8)
1910 CALL COLOR(9,7,1)
1920 CALL COLOR(10,7,1)
1930 CALL COLOR(2,16,1)
1940 CALL COLOR(2,14,1)
1950 CALL COLOR(2,16,1)
1960 CALL COLOR(2,11,1)
1970 CALL COLOR(2,16,1)
1980 CALL COLOR(2,7,1)
1990 CALL COLOR(2,16,1)
2000 CALL COLOR(2,6,1)
2010 GOTO 1930
2020 END
```

Program 3:

"Auld Lang Syne" (TI Extended BASIC)

```
90 REM TI EXTENDED BASIC
100 REM AULD LANG SYNE
110 CALL CLEAR :: CALL SCREEN(4)
120 CALL CHAR(96,"000101030307070F0
    F1F1F3F3F7F7FFFFFFFFFFFFFFFFFF
    FFFFFFFFFFFFFFFF")
130 T=600
140 CALL SOUND(T*1.1,262,5)!SHOULD
150 CALL CHAR(104,"00030F1F3F3F7F7F
    7F7F3F3F1F0F030000C0F0F8FCFCFEF
    EFEFEFCFCF8F0C000")
160 CALL SOUND(T*1.5,349,5,262,12,1
    75,15)!AULD
170 CALL VCHAR(8,5,98,9)
180 CALL VCHAR(8,4,96)
190 CALL VCHAR(9,4,97)
200 CALL SOUND(T/2,349,5,262,12,196
    ,15)!AC-
210 CALL SOUND(T,349,4,262,12,220,1
    5)!QUAINT-
220 CALL CHAR(108,"7F3F1F070F1F3F7F
    FEFCF8C0F0F8FCFE")
230 CALL SOUND(T,440,5,349,12,175,1
    5)!ANCE
240 CALL HCHAR(8,10,98,3)
250 CALL HCHAR(8,9,104)
260 CALL VCHAR(9,9,98,3)
270 CALL SOUND(T*1.5,392,5,330,12,1
    31,15)!BE
280 CALL HCHAR(12,9,105)
290 CALL HCHAR(12,10,98,3)
300 CALL VCHAR(8,13,106)
310 CALL VCHAR(9,13,98,7)
320 CALL SOUND(T/2,349,5,294,12,131
    ,15)!FOR-
330 CALL CHAR(94,"10387CD692103844"
    )
340 CALL SOUND(T,392,5,330,12,131,1
    5)!GOT
350 CALL HCHAR(16,13,107)
360 CALL HCHAR(16,10,98,3)
370 CALL HCHAR(15,9,98)
380 CALL HCHAR(16,9,105)
390 CALL SOUND(T,440,5,330,12,131,1
    5)!AND
400 CALL HCHAR(8,17,104)
410 CALL HCHAR(8,18,98,3)
420 CALL HCHAR(8,21,106)
430 CALL VCHAR(9,21,98,3)
440 CALL SOUND(T*1.5,349,6,220,12,1
    75,15)!NEV-
450 CALL VCHAR(9,17,98,3)
460 CALL HCHAR(12,17,108)
470 CALL HCHAR(12,18,98,3)
480 CALL HCHAR(12,21,109)
490 CALL SOUND(T/2,349,6,220,12,175
    ,15)!ER
```

```
500 CALL VCHAR(13,17,98,3)
510 CALL SOUND(T,440,4,349,12,175,1
    5)!BROUGHT
520 CALL VCHAR(16,17,105)
530 CALL HCHAR(16,18,98,3)
540 CALL HCHAR(16,21,107)
550 CALL SOUND(T,523,3,349,10,175,1
    3)!TO
560 CALL VCHAR(13,21,98,3)
570 CALL HCHAR(9,25,98)
580 CALL HCHAR(8,25,104)
590 CALL SOUND(3*T,587,2,349,8,233,
    10)!MIND
600 CALL HCHAR(8,26,98,3)
610 CALL HCHAR(8,29,106)
620 CALL VCHAR(9,29,98,3)
630 CALL HCHAR(12,27,98,2)
640 CALL HCHAR(12,29,109)
650 CALL VCHAR(13,29,98,3)
660 CALL HCHAR(16,29,107)
670 CALL HCHAR(16,26,98,3)
680 CALL HCHAR(16,25,105)
690 CALL HCHAR(15,25,98)
700 CALL SOUND(T,587,2,349,8,233,10
    )!SHOULD
710 CALL SCREEN(8)
720 PRINT " {3 SPACES}hbbbj
    {3 SPACES}hbbbj{3 SPACES}a"
730 CALL SOUND(T*1.5,523,3,349,10,2
    20,13)!AULD
740 PRINT " ab{3 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b"
750 CALL CHAR(33,"1010545454545444"
    )
760 CALL SOUND(T/2,440,4,349,12,175
    ,15)!AC-
770 PRINT "  b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b"
780 CALL SOUND(T,440,6,349,12,175,1
    5)!QUAINT-
790 PRINT "  b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b  b"
800 CALL SOUND(T,349,6,220,12,175,1
    5)!ANCE
810 PRINT "  b{3 SPACES}ibbbb
    {3 SPACES}lbbbm{3 SPACES}b  b"
820 CALL SOUND(T*1.5,392,6,330,12,1
    31,15)!BE
830 PRINT "  b{7 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {3 SPACES}bbbbb"
840 CALL SOUND(T/2,349,6,294,12,131
    ,15)!FOR-
850 PRINT "  b{7 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {6 SPACES}b"
860 CALL SOUND(T,392,6,330,12,131,1
    5)!GOT
870 PRINT "  b{3 SPACES}b
    {3 SPACES}b{3 SPACES}b
    {3 SPACES}b{6 SPACES}b"
880 CALL SOUND(T,440,6,330,12,131,1
    5)!AND
890 PRINT "  b{3 SPACES}ibbbk
    {3 SPACES}ibbbk{6 SPACES}b"
900 CALL SOUND(T*1.5,349,6,294,12,1
    47,15)!DAYS
910 PRINT
920 CALL SOUND(T/2,294,7,220,12,147
    ,15)!OF
930 PRINT
940 CALL SOUND(T,294,7,233,12,117,1
    5)!AULD
950 PRINT
960 CALL SOUND(T,262,8,233,14,131,1
    6)!LANG
970 PRINT
980 CALL SOUND(3*T,349,8,220,15,175
    ,17)!SYNE
990 PRINT : : :
1000 CALL SOUND(T,587,5,349,12,175,
     15)!FOR
1010 CALL COLOR(9,5,1):: CALL COLOR
     (10,5,1)
1020 CALL SOUND(T*1.5,523,5,349,12,
     175,15)!AULD
1030 CALL MAGNIFY(1)
1040 CALL CHAR(120,"92442892284492"
     )
1050 CALL SPRITE(#1,94,13,192,115,-
     9,0)
1060 CALL SPRITE(#28,33,16,198,115,
     -9,0)
1070 CALL SOUND(T/2,440,6,262,15)
1080 CALL SOUND(T,440,6,349,12,175,
     15)!LANG
1090 CALL CHAR(124,"003C424242423C"
     )
1100 CALL SOUND(T,349,6,110,18)
1110 CALL SOUND(T*1.5,392,6,330,14,
     131,16)!SYNE
1120 CALL DELSPRITE(#1,#28)
1130 FOR I=1 TO 10
1140 CALL SPRITE(#I,120,7,90,115)
1150 NEXT I
1160 CALL SOUND(T/2,349,6,294,12,13
     1,17)!MY
1170 CALL SCREEN(8)
1180 CALL MOTION(#1,-10,-10)
1190 CALL MOTION(#2,-10,10)
1200 CALL SOUND(T,392,7,330,15,131,
     17)!DEAR
1210 CALL MOTION(#3,-10,5)
1220 CALL MOTION(#4,-10,-5)
1230 CALL MOTION(#5,-10,0)
1240 CALL MOTION(#6,10,-10)
1250 CALL MOTION(#7,10,10)
1260 CALL SOUND(T,587,6,330,14,131,
     16)!FOR
1270 CALL MOTION(#8,10,-5)
1280 CALL MOTION(#9,10,5)
1290 CALL MOTION(#10,10,0)
1300 CALL SOUND(T*1.5,262,6,349,14,
     131,16)!AULD
1310 CALL COLOR(9,7,1):: CALL COLOR
     (10,7,1)
1320 FOR I=1 TO 5 :: CALL MOTION(#I
     ,0,0):: NEXT I
1330 CALL SOUND(T/2,440,7,131,16)
1340 CALL SOUND(T,440,6,349,14,175,
     16)!LANG
1350 FOR I=6 TO 10 :: CALL MOTION(#
     I,0,0):: NEXT I
1360 CALL SOUND(T,523,5,220,15)
1370 CALL SOUND(3*T,587,3,349,12,23
     3,14)!SYNE
1380 C=16
```

```
1390 CALL SPRITE(#11,42,C,90,115,-1
     0,-16)
1400 CALL SPRITE(#12,42,C,90,115,-1
     0,18)
1410 CALL SPRITE(#13,42,C,90,115,-1
     1,-8)
1420 CALL SPRITE(#14,42,C,90,115,-1
     1,8)
1430 CALL SPRITE(#15,42,C,90,115,-1
     2,0)
1440 CALL SPRITE(#16,42,C,90,115,9,
     -16)
1450 CALL SPRITE(#17,42,C,90,115,9,
     18)
1460 CALL SPRITE(#18,42,C,90,115,13
     ,-9)
1470 CALL SPRITE(#19,42,C,90,115,13
     ,9)
1480 CALL SPRITE(#20,42,C,90,115,15
     ,0)
1490 CALL SOUND(T,698,2,349,13,233,
     15)!WE'LL
1500 FOR I=11 TO 20 :: CALL MOTION(
     #I,0,0):: NEXT I
1510 CALL SOUND(T*1.5,523,3,349,12,
     220,14)!TAKE
1520 CALL COLOR(9,11,1):: CALL COLO
     R(10,11,1)
1530 CALL SOUND(T/2,440,4,349,13,17
     5,15)!A
1540 CALL SOUND(T,440,4,349,13,175,
     15)!CUP
1550 CALL SPRITE(#21,124,5,192,30,-
     12,0)
1560 CALL SPRITE(#22,124,5,192,240,
     -7,0)
1570 CALL SPRITE(#23,124,5,192,64,-
     20,0)
1580 CALL SPRITE(#24,124,5,192,192,
     -24,0)
1590 CALL SOUND(T,349,5,262,13,110,
     15)!O'
1600 CALL SPRITE(#25,124,5,192,103,
     -14,0)
1610 CALL SPRITE(#26,124,5,192,164,
     -30,0)
1620 CALL SPRITE(#27,124,5,192,120,
     -23,0)
1630 CALL SOUND(T*1.5,392,5,330,13,
     131,15)!KIND-
1640 CALL COLOR(9,14,1):: CALL COLO
     R(10,14,1)
1650 CALL SOUND(T/2,349,5,294,13,13
     1,15)!NESS
1660 CALL SOUND(T,392,5,330,12,131,
     15)!YET
1670 CALL SOUND(T/2,440,5,330,13,13
     9,15)!FOR
1680 CALL SOUND(T/2,392,5,330,13,13
     9,15)
1690 CALL SOUND(T*1.5,349,5,294,14,
     147,16)!AULD
1700 CALL COLOR(9,16,1):: CALL COLO
     R(10,16,1)
1710 CALL SOUND(T/2,294,6,220,14,17
     5,16)
1720 CALL SOUND(T,294,7,233,15,117,
     17)!LANG
1730 CALL SCREEN(11)
1740 CALL SOUND(T,262,7,165,15,131,
     17)
1750 CALL SOUND(4*T,349,6,220,15,17
     5,17)!SYNE
1760 CALL SCREEN(8)
1770 CALL COLOR(9,7,1):: CALL COLOR
     (10,7,1)
1780 FOR I=1 TO 20 :: CALL COLOR(#I
     ,16):: NEXT I
1790 FOR I=1 TO 20 :: CALL COLOR(#I
     ,14):: NEXT I
1800 FOR I=1 TO 20 :: CALL COLOR(#I
     ,12):: NEXT I
1810 FOR I=1 TO 20 :: CALL COLOR(#I
     ,7):: NEXT I
1820 GOTO 1780
1830 END
```

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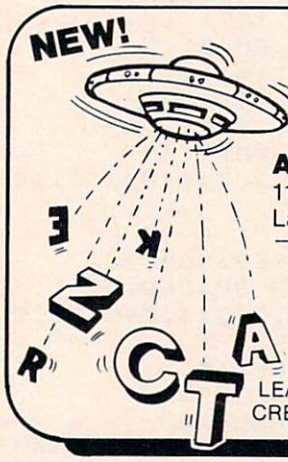

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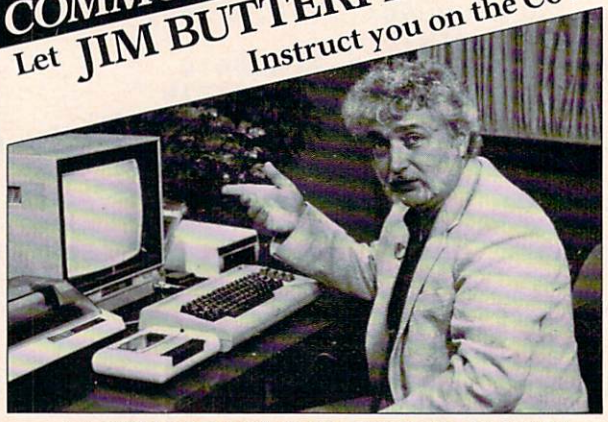

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ART MUSEUM

Floyd Beaston

Both the Commodore VIC and 64 have graphics characters right on the keys. This program lets you take advantage of these graphics by allowing you to SAVE and LOAD screen pictures made using character graphics.

My eight-year-old son loves to "draw" artwork on the screen using combinations of the graphics symbols on the keys. Because the "artworks" vanished forever when we turned off the computer, my son became more and more frustrated.

These programs for the VIC and 64 were written to help with this problem by allowing you to SAVE and LOAD all characters, including graphics symbols, on the screen.

To use the VIC version, first remove any expansion board and then type in Program 1. Then enter this line:

```
CLR:POKE46,PEEK(46)+4
```

and SAVE to disk or tape.

Operating The VIC Version

If you wish to draw a picture (to later SAVE), LOAD the program and change line 1 to:

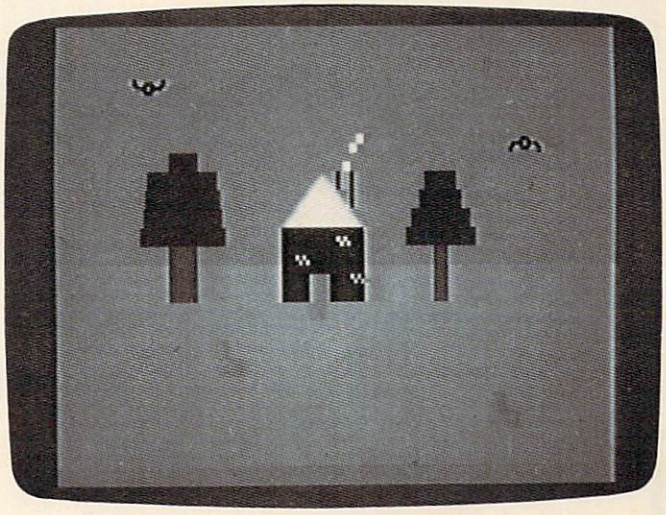
```
1 REM
```

Next, clear your screen and begin drawing. When you are finished, change the cursor color to match the background color, then type RUN. (You won't be able to see the command RUN since it will be the same color as the background.) In a few seconds, change the cursor color back to a visible color and then SAVE the program to tape or disk. Your screen will also be saved.

To retrieve your picture, LOAD the program from tape or disk and change line 1 to:

```
1 GOTO20
```

This will magically return your picture to the screen.



"Art Museum" can save any screen drawing to tape or disk. 64 version.

Program 1: Art Museum (VIC Version)

```
0 S=7680:C=38400:GOSUB63999
1 GOTO20
10 FORJ=0TO505:POKEML+J,PEEK(S+J):POKEML+
   506+J,PEEK(C+J):NEXT:END
20 FORJ=0TO505:POKES+J,PEEK(ML+J):POKEC+J
   ,PEEK(ML+506+J):NEXT:PRINT"{HOME}";
21 GOTO21
63999 ML=PEEK(61)+PEEK(62)*256+31:RETURN
```

Program 2: Art Museum (64 Version)

```
1 GOSUB4010:INPUT "{WHT}{CLR}LOAD FILE";W
  $:IFW$="N"THENPRINT"{CLR}":END
```

64 Notes

The 64 version of "Art Museum" (Program 2) stores the contents of screen memory at 16384 ($4000) and the contents of color memory at 1750. To use this version, first type in and SAVE the program, then draw your picture on the screen using the cursor control keys and character graphics. When your picture is complete, change the cursor color to the background color and then invisibly type GOTO 10 and press RETURN. Then press S (for SAVE). This saves your screen creation at 16384. After a wait of about 25 seconds, change the cursor color to a visible color and clear the screen.

If you wish to SAVE your screen to tape or disk, type GOSUB 4010:GOTO 1000 and press RETURN. You will then be prompted for filename and storage medium (tape or disk). After responding to these prompts, your screen will be saved to disk or tape. To LOAD a file, type RUN and the program will prompt for filename and storage medium. Once your file is loaded, type GOTO10 and hit any key except S. Your stored file will gradually appear on the screen.

```
2 INPUT"DISK OR TAPE";E$:IFE$="D"THENE=8:
  GOTO1900
3 E=1:GOTO1900
10 POKE55,255:POKE56,63
20 FORT=0TO200:NEXT
30 GETA$:IFA$=""THEN30
35 CO=55296:SC=1024:DR=16384:CR=DR+1024
40 ON((A$="S")+2)GOTO100,200
100 FORT=0TO999:POKEDR+T,PEEK(SC+T)
110 POKECR+T,(PEEK(CO+T)AND15)
120 NEXT:PRINT"{HOME}":END
200 FORT=0TO999:POKESC+T,PEEK(DR+T)
210 POKECO+T,PEEK(CR+T)
220 NEXT:PRINT"{HOME}":END
1000 REM SAVE SCREEN
1010 INPUT"SAVE SCREEN Y OR N";S$
1020 IF S$="N"THEN END
1021 POKE250,0:POKE251,64
1022 POKE252,0:POKE253,96
1030 INPUT"FILE NAME FOR SCREEN";F$
1035 F$="0:"+F$
1036 INPUT"{WHT}DISK OR TAPE";E$:IFE$="D"
     THENE=8:GOTO1040
1037 E=1
1040 OPEN1,E,1,F$:SYS49152:CLOSE1:END
1900 INPUT "FILENAME";L$:L$="0:"+L$
2000 OPEN1,E,0,L$:SYS49162:CLOSE1:END
4010 I=49152
4020 READ A:IF A=256 THEN RETURN
4030 POKE I,A:I=I+1:GOTO 4020
49152 DATA 166,252,164,253,169,250,32
49160 DATA 216,255,96,165,184,166,186
49168 DATA 160,255,32,186,255,169,0
49176 DATA 162,0,160,64,32,213,255
49184 DATA 96,256
```

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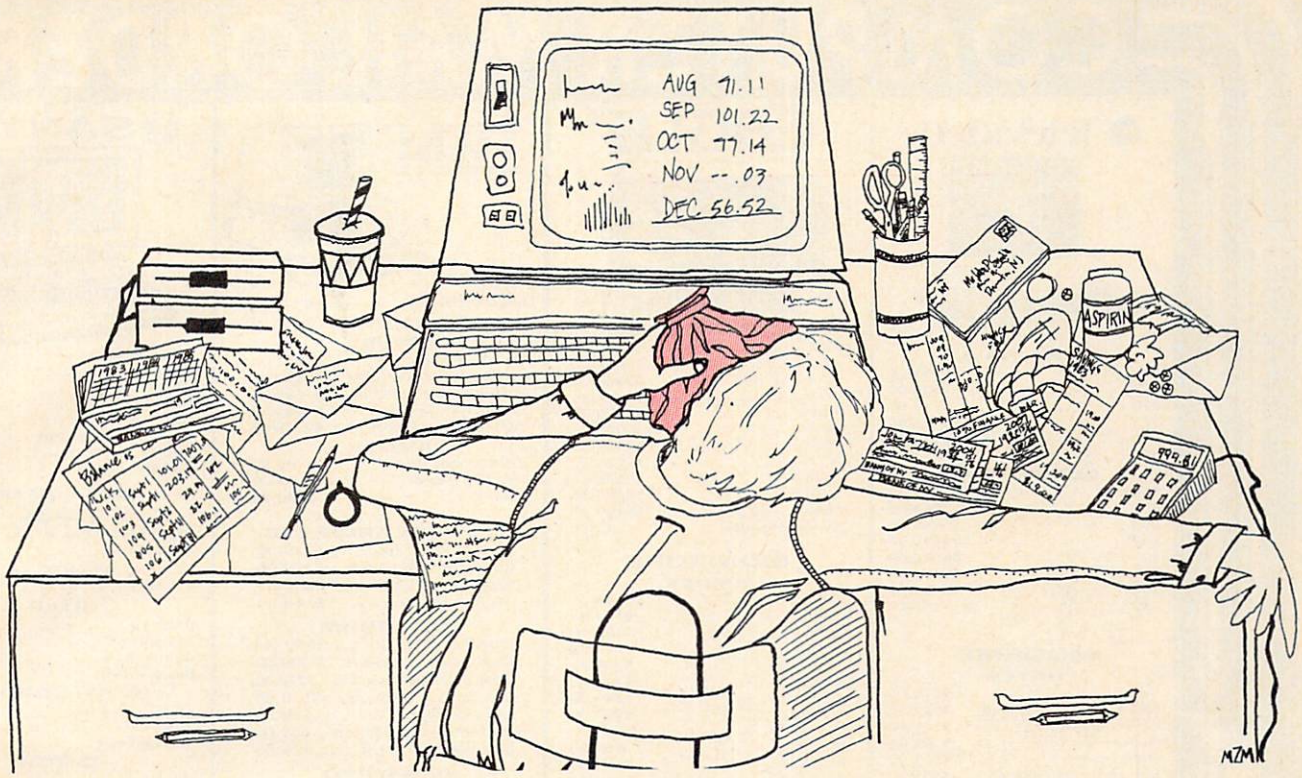

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INSIGHT: Atari

Bill Wilkinson

This month I will discuss extended memory management on the Atari computers. Before I start, though, I would like just to chat for a bit. (If you are waiting for the last part of the series on self-relocatable code, be patient. It's just bigger than I expected it to be, so I've got to massage it a bit more.)

Some Small Talk About Computers

Today I read an interview with Alan Kay in *Technology Illustrated*. As many of you probably know, Alan Kay was perhaps the most instrumental person in the development of the Smalltalk language. (Or is it an operating system? Or is it more properly called simply an "environment"?)

The work he did on Smalltalk while at Xerox caused him to believe that computers were destined to become a household tool, as common as, say, the television set. (Which may seem a mundane belief today, but Kay was saying such things five to ten years ago.) Well, Atari apparently liked Kay's philosophy, vision, and capabilities, and hired him awhile back.

The article I read interested me in two ways. First, it labeled Kay "Atari's Chief of Games." Well, I had been led to believe that he had been brought to Atari to head research and development, presumably to lead Atari into the generation beyond Smalltalk (a logical presumption, since he'd stated that he felt Smalltalk had served its purpose, was obsolete, etc.).

Anyway, with my orientation toward languages and systems, I saw "Chief of Games" as a step downward. Yet the interview made it clear that Kay felt he was in perhaps one of the most challenging positions possible. Hmmm. What has changed? Are games truly the most useful purpose of a computer right now? The marketplace certainly seems to think so. It is food for thought.

The second thing in the article which really got my CPU stirred up was Kay's view of the computer. I had always been under the impression that he believed his real goal in life was to enable everyone not only to use the computer, but to actually command and manipulate it. (I hesitate to say "program it," but then Smalltalk *is* a language.) In the interview, though, Kay stated he was beginning to fear that perhaps the computer was not so much a household tool as it was a fine instrument, like a violin. He strengthened the analogy by noting that very few people can play the violin, just as very few people can properly use a computer.

Well, I for one believe that not only is the analogy inappropriate, but its projection of gloom and pessimism about the future of computers is not justified. Granted, the analogy may hold today. After all, only about 1 percent of the United States population can claim to be able to program at all (or play "Twinkle, Twinkle, Little Star" on the violin). Probably less than .1 percent produce acceptable application programs (or play in a community orchestra or equivalent). Dare we guess that .01 percent are commercial programmers (or make their living playing the violin)? Can it be that only .001 percent can actually write systems and languages (or are the guest soloists of the concert world)?

Actually, these proportions are just order-of-magnitude guesses, but they do seem to support Mr. Kay's analogy. But I say that his analogy has validity mainly because the computer is still such a relatively "rare" instrument. Personally, I prefer a different analogy.

When computers are as much a part of everyday life in this country as automobiles are now (and I firmly believe that they will be), then I think they will be treated much as automobiles are.

Let me sidetrack a little. Here in California, the State has decreed that all high school students shall take a course in "computer literacy." So what happens? Every high school is scrambling to buy one or two computers and begin teaching every kid how to program in BASIC. Great, right? *Nonsense!*

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or program a computer at all if the student/computer ratio is above 3 to 1. More importantly, I think it is senseless to equate "computer literacy" with "learning to program in BASIC." After all, "automobile literacy" consists of learning traffic laws, safe driving techniques, and actually starting to drive a car (it's usually called "Driver Training").

"Automobile expertise," on the other hand, consists of learning what tools do what, the theory and practice of internal combustion engines, and how to maintain and repair an automobile (and this is usually called "Auto Shop"). Does every student take driver training? Yes, or nearly so. Does every student take auto shop? No. Not by a long shot.

So, I believe, it should be with computer literacy. Don't teach everyone how to program. (What would we do with a nation of programmers? The same thing we would do with a nation of auto mechanics?) Instead, teach everyone how to use a computer to do word processing, to balance their budget, to access data bases, and the list could be quite long.

And, yes, keep the computer programming classes. But keep them on the same basis that auto shop classes are offered — as electives, for those interested in learning more than how to "drive" their computers or cars.

Why this confusion of computer literacy and computer expertise among schools and teachers? Partly because the computer industry has promoted the view. (Perhaps fearing that current applications programs are inadequate to a classroom situation?) Partly because of a dismal lack of education and information on the part of the educators. (Pity the poor math or history teacher who is nearing retirement. Suddenly he/she is forced to learn enough about these nasty machines to be able to teach some kids how to use it. Do you wonder that the path of least resistance is most often chosen?) Mostly, I suppose, because BASIC comes built into each machine, while good text processors, spreadsheet programs, etc., cost extra, money which most schools don't have.

So how does this tirade relate to either Alan Kay or you, my patient reader? Well, first of all, I think the analogy of car and computer is a better one than violin and computer. And, perhaps, if computer companies started trying to design mass consumable "cars" instead of trying to ply the public with precision instruments, it is a future that will come true. To be fair, I think that companies such as Atari and Commodore and Apple and others are starting to do so already. But my cynicism leads me to believe that they are driven by the current market, not by the future one.

You're Ahead Of Your Time

Perhaps more importantly, though, I am trying to convey the message that those of you who read this column (and this magazine) are, in some sense, ahead of your time. You are, indeed, the violinists that Alan Kay perceives. Some of you are just learning to play your first notes. Others of you are already tackling the great concertos. But, when the computer revolution really arrives, you will all have the advantage of having already taken at least your first "auto shop" course. So, if you enjoy your computer (and particularly if you enjoy programming), don't give it up easily. And certainly don't give it up now. Someday, others will appreciate your art, however humble or glorious it may be.

Did that sound like a sermon? If so, I apologize. But it's my view of both the present and the future of computers and programming. One last sidelight before we move on: On hearing me espouse the views above, someone once asked me what my position in the hierarchy was, as a person who helped design (as opposed to program) operating systems and first languages for new machines. Actually, that's an easy question: I'm simply a composer. And so, I think, are such people as Alan Kay.

You Can Bank On It

All of the new Atari XL computers (including the 1200XL) will contain 64K bytes of RAM (the 600XL requires an external RAM pack to do so). And all contain 16K bytes of Operating System ROM space. And, further, all (except the 1200XL) include good old Atari 8K BASIC. Let's see here — 64K plus 16K plus 8K — that's over 90,000 bytes of space.

Wait a minute, though. If I plug in a 16K cartridge (such as AtariWriter or ACTION! or BASIC XL), then I could have 104K bytes of RAM and ROM. Wow. That's really nifty, right? Well...

Have you read this column often enough to know that "Well..." means "not really" or "there's more to come"? No? Well...

Not really. To begin with, all Atari computers are built around the same CPU (Central Processing Unit), the 6502. (Which, incidentally, is the same chip used in most Commodore computers and all Apple machines except the Lisa.) However, there is a fundamental restriction involved when using a 6502: There is simply no way to access more than 64K bytes (65,536 bytes) at one time. How, then, can the Atari use 104K bytes? Is someone fibbing to us?

The key here is the phrase "at one time." A juggler may be able to juggle only four things at a time. Does that mean he always juggles the same four objects? Should we presume that the 6502 must always work with the same 64K bytes? Of course not.

In point of fact, the new XL machines allow the 6502 a number of choices about which bytes it will "juggle." How the 6502 makes its choice is

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the subject of this section.

Actually, there is no magic formula or scheme which enables the various choices. In fact, various choices are made by differing means. Generally, the choice is "consciously" made by the program currently in control of the machine. And it makes the choice simply by (usually) storing something in a particular memory location. Confused? Let's digress a little.

Some CPUs (including microcomputers and minis and maxis) treat input/output as a separate domain from general memory. For example, the 8080/Z-80 group of processors allow up to 256 separate input and output ports, which are completely separated from the general RAM/ROM memory (they even have special instructions specifically for reading/writing these I/O ports). On the other hand, many machines (such as the 6800, 68000, and 6502 families, as well as such giants as the PDP-11 series) simply treat input/output ports as part of the general machine memory.

Efficient And Easily Learned

The advantages and disadvantages of each scheme are a subject of hot debate, but I will only present a single aspect of each here: Keeping the I/O ports out of general memory allows a true 64K bytes of RAM when using an 8- or 16-bit microprocessor. Allowing I/O to be treated as part of memory means that any instruction which can access RAM or ROM can also access a port, often resulting in efficient and easy-to-learn coding.

Anyway, note that the 6502 does, indeed, use what is called "memory mapped I/O," and Atari computers do, as a consequence, reserve 2K bytes of memory (addressed from $D000 to $D7FF) which is specifically designed for I/O port addresses. (If losing 2K of your space seems excessive, pity the Apple owner who loses 4K.)

In the case of the XL machines, then, one simply changes the value in an I/O port — which appears to one's program as a memory address — and presto, a different choice of "jugglable" memory is made. But what I/O port to use? Did you notice the fact that Atari 400 and 800 computers have four joystick ports while the XL machines have only two? Guess which ports are now used for memory juggling. Did you need more than one guess?

For the more hardware-oriented of you out there, I will note that all four Atari joystick ports are actually nibble-sized pieces of a 6820 (or 6520) PIA (Peripheral Interface Adapter). The PIA is a very flexible chip; it allows each of its 16 I/O pins to be separately configured to be either an Input line or an Output line. In the case of the 400 and 800, all 16 lines are configured as Input, since they are all used to read the four directional switches of an Atari joystick. In the case of the XL machines, some of them have been changed to Output lines, thus enabling them to act as electronic switches.

On the 1200XL, for example, two of them are used to control the L1 and L2 status LEDs. And (you saw this coming, I presume) two of them choose certain configurations of the computer's memory. (On the other XL machines, still another line is used to control still another possible configuration.)

Since we are discussing memory configuration choices, I might as well confuse the issue a bit more by also mentioning how we at OSS implemented our new SuperCartridges. It is probably no accident that Atari provides the cartridge slot on all machines with a line labeled "CARCTL", an abbreviation for CARtridge Con-TroL. Actually, this line is active whenever any memory location from $D500 to $D5FF is accessed. Since no Atari cartridges take advantage of this line, we thought it was time that we did so.

One At A Time

About now, it is past time for a diagram. The figure shows all the possible choices of memory configuration by placing them in memory address order. Note, though, that the 64K addressing restriction of the 6502 applies. Hence, when two or more choices are given for a particular address range in memory, remember that only one such choice may be active at any given time. For each address range where a choice is available, there are two or more *banks* of memory. And choosing one bank over another is called *bank switching* or *bank selection*.

For example, I might choose to use BANK1 of the SuperCartridge while at the same time choosing the RAM BANK of system memory. The important thing to note here is that each set of banks (that is, parallel memory segments), as shown in the figure, is independently bank selectable.

Also, some bank choices are not available at the software level. For example, when you plug in a Microsoft BASIC cartridge, you have 16K bytes of ROM from $8000 to $BFFF. You have no RAM in that address range. You have no choice in the matter. This is, then, hardware bank selection.

The advantage of hardware bank selection is that it is essentially foolproof. If the hardware removes a bank of RAM from your program's "vision," your program can't get into trouble trying to use that bank.

But the advantage of software-selectable banks is, quite simply, that they allow you to expand the capabilities of your machine. If you look at the figure, you can see that a SuperCartridge allows you 16K bytes of programming power while occupying only two 4K byte banks at any given time.

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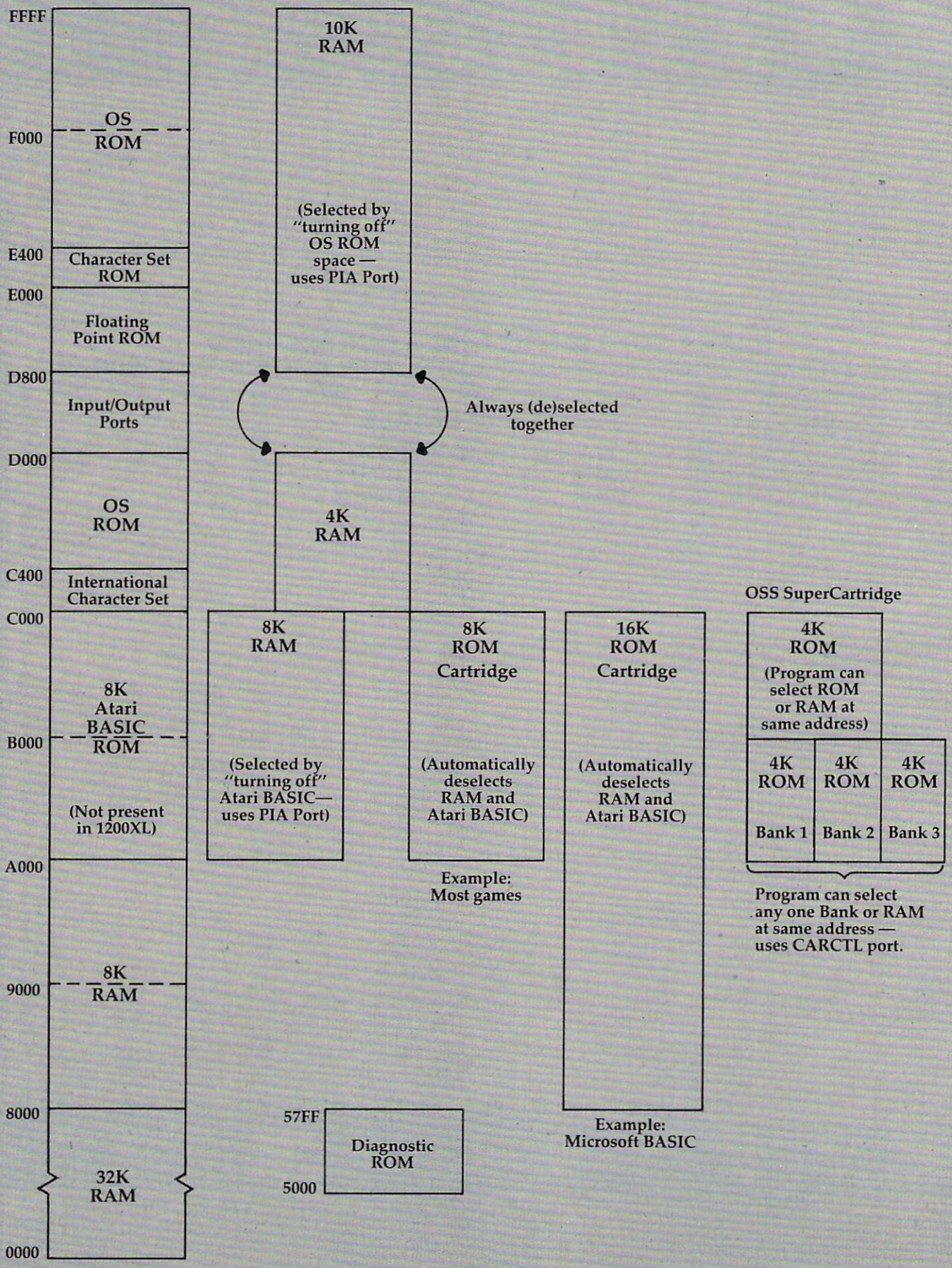
Memory Map Of Atari XL Computers (Showing Parallel Memory Banks At Same Addresses)



And the purpose of this discussion? To show that the XL machines really do have a lot of latent power. How do we make it un-latent? Well....

As I write this article, the number of commercially available programs which allow you to take advantage of the extra 14K bytes of RAM on an XL machine is countable on the fingers of my left foot. Zero. By the time you read this, there will likely be products heading your way that will justify the purchase of an XL machine (or a 64K memory board, such as the one from Mosaic Electronics, for your 800).

Since I am obviously most familiar with DOS XL, let me explain a little of how it works.

When DOS XL boots into an XL computer, it first establishes a set of jump vectors for the various interrupt routines. Why? Because any IRQ, NMI, or SYSTEM RESET will attempt to jump through the vectors which must (by 6502 CPU law) be located at addresses $FFFA through $FFFF. If we deselect the OS ROM bank in order to enable the RAM bank at the same addresses, the contents of these critical addresses are unpredictable. We *must* supply some valid routine addresses or the system will crash.

DOS XL puts most of the DOS code in the RAM bank which is "under" the OS ROMs. It also leaves a piece of itself at the conventional DOS load address of $700 (an area of memory which is not bank selectable). Then, if there is a BASIC cartridge in the machine, it selects the OS ROM bank and jumps to BASIC.

So long as BASIC makes no calls on DOS, all is calm and expected. However, watch what happens when (for example) we try to open a file from BASIC.

1. BASIC sets up an IOCB with a pointer to the filename. Since the filename was specified by the user, the pointer will contain an address somewhere between about $A00 and $9C00. BASIC makes a call to $E456, the CIO entry point.

2. CIO determines that the device requested is actually the disk file manager and uses the "D:" device table to determine the address of the disk's open file routine. It passes control to that routine.

3. Note that the "D:" device table and at least the first part of the file open routine must be in nonselectable RAM (that is, at or near $700). The file open routine is a big one, so it selects the DOS XL RAM (disabling the OS ROM) and jumps to the main part of the code.

4. The main code is able to examine the filename since it is in nonselectable memory, so the file open is performed if possible. The main code exits back to the tail end of the OPEN code, near $700.

5. This tail end then simply reselects the ROM bank and returns to where it was called (somewhere in CIO).

6. When CIO is finished, it returns control to BASIC.

Wasn't that fun? For even more fun, try to trace what happens if interrupts occur during any or all of the above steps.

More Space

But why do we go through all this? Because, even though Atari saw fit to include all this good memory bank selection capability, they provided no software to use it. So why not just forget the bank select and pretend we are running on an Atari 800 or 400? Because the net gain to you, the BASIC or ACTION! or Assembler or whatever user, is about 5,000 bytes of user space. Your programs can be 5K bytes bigger. Your spreadsheets can contain many more cells. You can edit more text.

Of course, some programs (such as VisiCalc) which do not use a standard DOS or which use a heavily protected disk (such as the Microsoft BASIC extensions) will not be able to take advantage of the extra memory. But they, too, can use these techniques to extend their capabilities if the software companies producing them will decide that the XL machines are worth the little extra effort. ©

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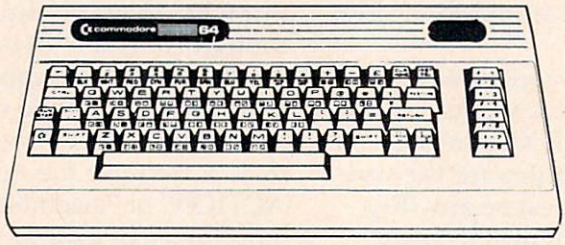

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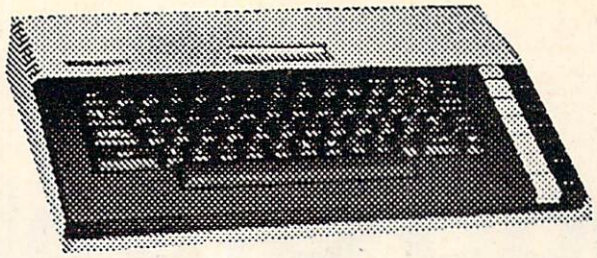

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Bitmap Graphics On The 64

Michael Tinglof

High-resolution graphics are achieved by bitmapping. Here's a tutorial and an explanation of what happens in the 64's memory as you bitmap. Also included is a sample program which illustrates the techniques discussed.

High-resolution images of 320 by 200 point (called *pixel*) resolution are possible on the 64. To create these images, the 64's VIC-II video chip uses a technique called bitmapping. Simply defined, this means that every bit in a selected area of memory represents one pixel (the smallest point of light) on the high-resolution screen. Thus, by setting or clearing appropriate bits, a picture can be formed.

You might ask "Why use bitmapped graphics when sprites are available and far more convenient to use?" The answer is simple: Each graphics mode has its own purpose. Several of the main reasons for using bitmapped graphics are to create graphs of formulas or statistics, to create high-resolution color pictures, and to create a detailed background for use with sprites, such as for a game.

Binary Operations

Before the bitmapped mode can be used effectively, it is important to have a basic understanding of binary arithmetic (see the section "Binary And Bitmapping" accompanying this article) and the logical AND and OR commands. Basically, they are used to selectively set and clear one or more bits in a byte. AND and OR cause a bit-by-bit comparison of two bytes to produce a third byte. In the case of AND, if both bits are on (1), the resulting bit is on; and in the case of OR, if *either* bit, or both, is on, the resulting bit, likewise, is on. For example:

```
    10101011        00110001
AND 11011011    OR  10101010
  = 10001011      = 10111011
```

The bits in a byte are usually numbered as follows:

```
7 6 5 4 3 2 1 0
```

AND is used to selectively clear bits, and OR is used to set bits. For example:

Given: 10100101, clear bit 5. To do this, define a byte with bit 5 set (0010000), then take the inverse (properly termed "complement") of the byte by changing all 1's to 0's and vice versa. Finally, AND the calculated byte with the given byte:

```
    10100101  (given)
AND 11011111  (calculated)
    10000101
```

Given: 10011010, set bit 6. To do this, define a byte with bit 6 set. Then OR this byte with the given byte:

```
    10011010  (given)
OR  01000000  (calculated)
    11011010
```

Remember that when BASIC is used, all binary bytes must be converted to decimal first. BASIC's AND or OR instructions will then work as described above.

Setting Up The VIC-II Chip

With an understanding of ANDs and ORs, a high-resolution picture can be created. The first step is to select an area of memory 8,000 bytes in length for the bitmap.

The VIC-II chip accesses only one 16K block of memory at a time. Upon power-up, the VIC-II sees the first 16K from locations 0 to 16383. All video operations, including those for screen mem-

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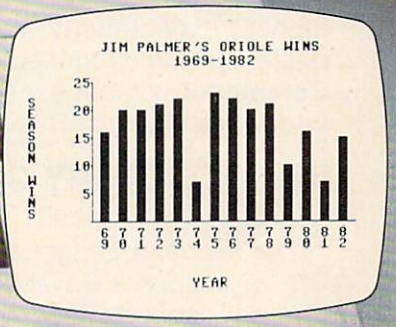

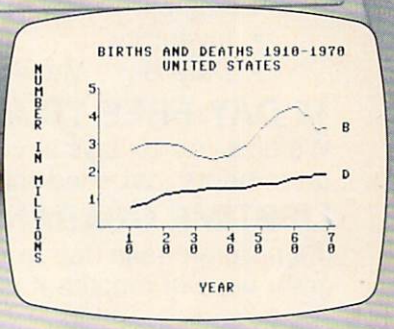

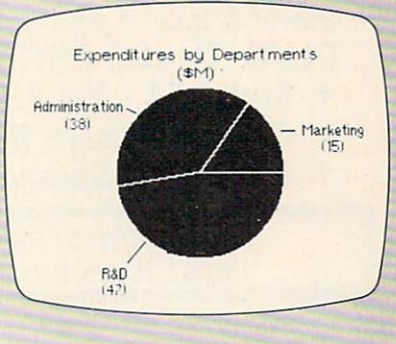

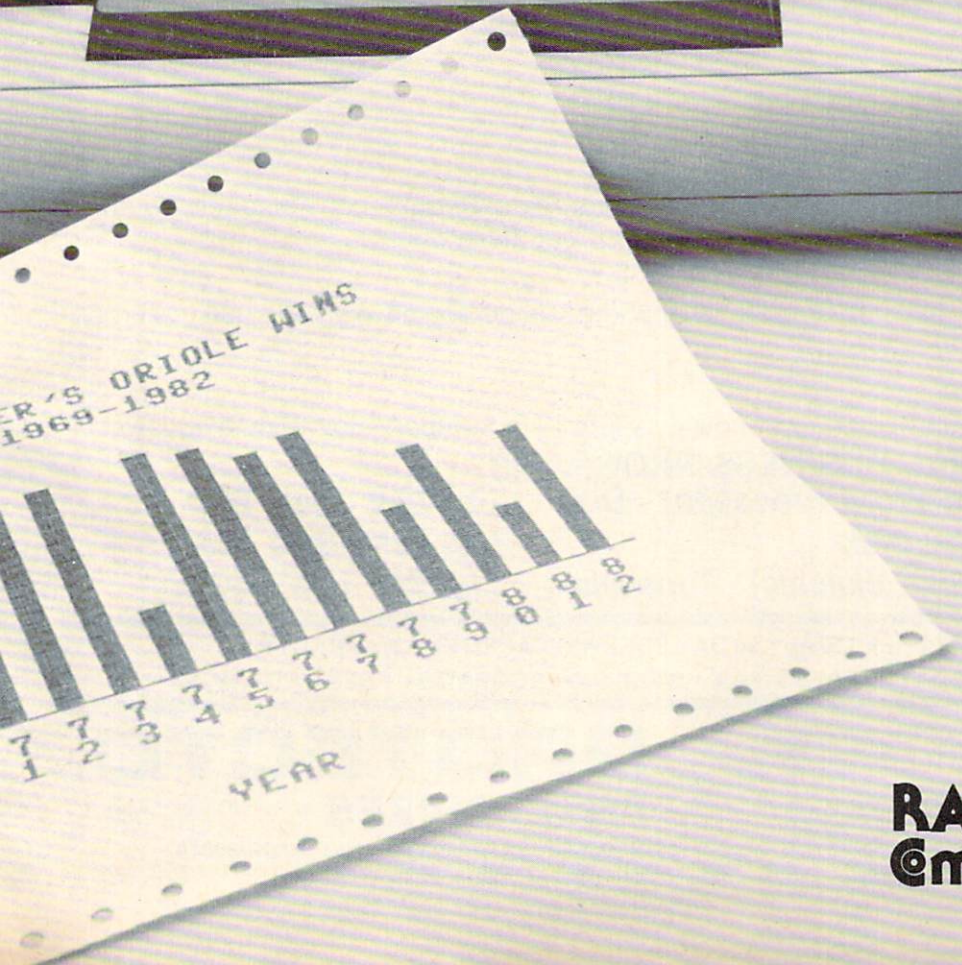

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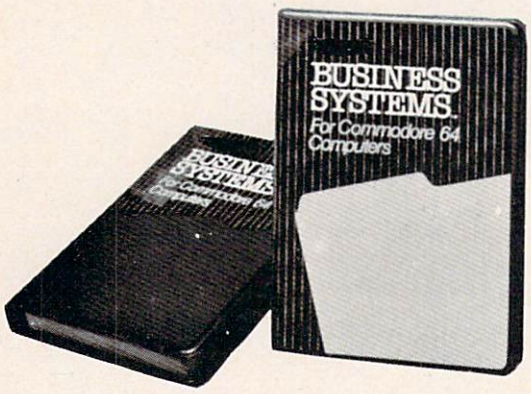

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ory and sprite definitions, access the memory in this area. There is no room in this block for an 8K bitmap, however, without conflicting with BASIC. The best solution is to select a different 16K block. (Bits 1 and 0 of address 56576 control where the block is placed in memory.) The combinations of these two bits and the range of addresses they represent are as follows:

decimal	binary	address
0	00	49152–65535
1	01	32768–49151
2	10	16384–32767
3	11	0–16383

Note that each block starts at an even 16K boundary. To select a memory block for the VIC-II chip, use the following command:

```
POKE 56576, Y
```

where Y is one of the decimal values from the above table. The best block to choose when using a bitmap and BASIC is number 2:

```
POKE 56576, 2
```

Within this block, two more areas must be selected: one for the 8K bitmap and one for the 1K screen memory. Address 53272 is used to control these two memory regions. One bit in this byte controls which 8K section in the 16K block is used for the bitmap; four bits control which 1024-byte area is used as the screen memory; and three bits are not used. The bits are arranged in address 53272 as follows:

7 6 5 4	3	2 1 0
screen memory	bit-map	x x x not used

The areas selected must fall on even boundaries — that is, their starting address must be a multiple of their size. For example, if the 16K block selected is from 0 to 16383, the screen memory can fall on 0, 1024, 2048, 4096, and so on. The following table can be used to determine which block should be used for screen memory or the bitmap:

Base plus	screen memory block	bitmap block
0	0	0
1024	1	
2048	2	
3072	3	
4096	4	
5120	5	
6144	6	
7168	7	
8192	8	1
9216	9	
10240	10	
11264	11	
12288	12	
13312	13	
14336	14	
15360	15	

where Base is the first address in the selected 16K block. To set 53272, use the following formula:

```
POKE 53272,  screen memory block * 16 + bitmap
  block * 8
```

If you are using the bitmap and BASIC at the same time, use the following POKE:

```
POKE 53272,120
```

This sets the screen memory block to seven, and the bitmap block to eight. For the 16K block suggested for use with BASIC, this means that screen memory starts at 23552 and the bitmap starts at 24576.

Once the memory pointers have been set, the VIC-II chip must be told to display the bitmap on the screen. Bit 5 of 53265 turns on the bitmap mode, that is, displays bitmap memory. To set this bit, use the following POKE command:

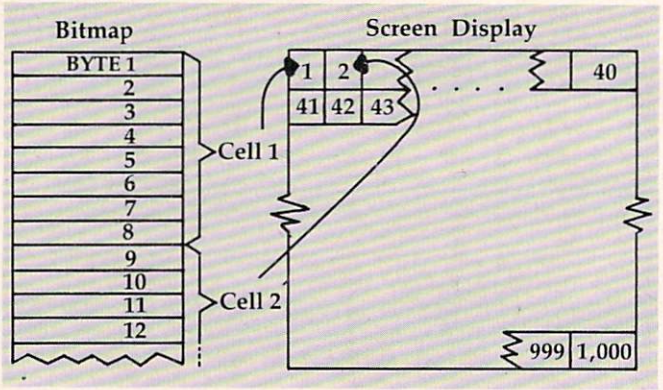
```
POKE 53265, PEEK(53265) OR 2↑5
```

Drawing The Picture

A high-resolution picture can now be created — all you have to do is set and/or clear the appropriate bits in bitmap memory. The problem is determining which bit controls which pixel. This requires an understanding of how the VIC-II chip draws the bitmap on the screen.

The bitmap memory is constructed similar to screen memory in text mode — it is broken into 1000 areas, each eight bytes in size, which we'll call *cells*.

These cells are arranged contiguously in memory — cell 1 follows cell 0, cell 2 follows cell 1, and so on. They are arranged in the bitmap in an order similar to that of screen memory in the text mode, 40 cells per row, 25 rows. The whole process, as described so far, can be illustrated as follows:



Each cell controls an area of 64 pixels arranged in an 8 by 8 matrix. The first byte in the cell controls the top row of pixels in that matrix, the second byte controls the row beneath, and so on down.

The eight bits in each byte control one pixel in that row — the highest valued bit controls the leftmost pixel and so on through the lowest valued bit, which controls the rightmost pixel. Graphically, the process works as follows:

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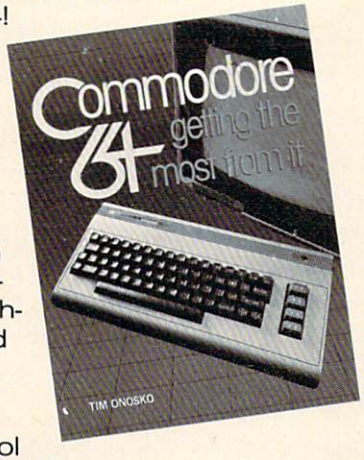

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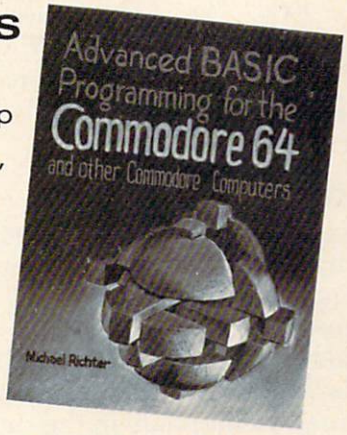

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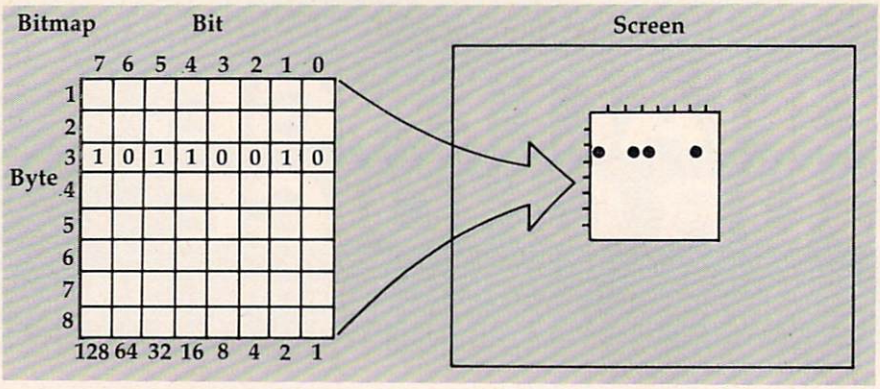

Using X and Y coordinates is cumbersome with this system. If this type of plotting is needed, the following equations will determine which bit to set for the X,Y coordinate:

```
Y1 = INT(Y/8)*8      determines which row of cells
X1 = INT(X/8)*8      determines which cell on the
                     above row
AD = Y1*320 + X1 + Y - Y1 + start of bitmap memory
                     determines address of proper byte
BT = 7 - X1          determines which bit to set
POKE AD, PEEK (AD) OR 2 ↑ BT    sets the bit
```

If you have been following our example setup commands, use a starting address for the bitmap of 24576.

Adding Color

Color is an important part of high-resolution graphics. Each of the 1000 bytes in screen memory controls the color displayed for one cell. Note that screen memory controls the color *only* in bitmap mode — in normal text mode, it contains the characters displayed on the screen. The bytes in screen memory are in the same order as the cells in the bitmap (the color of cell 650 is controlled by byte 650 in screen memory). In each byte, four bits are used to control the color of each bit in the corresponding cell of the bitmap, and four bits are used to control the color of bits equal to zero. These bits are arranged in each byte of screen memory as follows:

7 6 5 4	3 2 1 0
color of bits = 1	color of bits = 0

The colors and their corresponding values are listed on page 159 of the *User's Guide*. Once the values for the desired colors have been found, use the following formula:

```
(color of bits = 1)*16 + (color of bits = 0)
```

POKE this value into the appropriate byte of screen memory. Remember that attempting to change the color of one pixel will change the colors of all pixels in that cell of bitmap memory.

Note that screen memory for our working example begins at address 23552.

Recall that this method can be used to create a picture with 320 by 200 pixel resolution. Another bitmap mode is available, however. This second mode allows four colors in each cell rather than two colors as demonstrated above. There is one catch: resolution is reduced to 160 by 200 pixels, and each pixel is twice as wide. The multicolor mode is enabled by turning on bit 4 of location 53270. Use this command to enable multicolor mode:

```
POKE 53270, PEEK(53270) OR 2 ↑ 4
```

Each pixel is now represented by two bits. These two bits have four possible combinations, resulting in four possible colors. To find the color each bit combination represents, several memory locations and/or areas are accessed: screen memory, color memory (this is always from 55296 to 55319), and the background color register at 53281. Color memory is arranged in the same order as screen memory. The following chart shows which bit combinations access which areas of memory:

Bit Combination	color from
00	background register (53281)
01	screen memory (4 bits of greatest value; same as bit equal to one in two-color mode)
10	screen memory (4 bits of least value; as bit equal to 0)
11	color memory

Remember that three of the four colors selected can be different for each cell in the bitmap. The method used to draw the bitmap on the screen in two-color mode is used in the multicolor mode — only now, the bits are grouped together into pairs. The pairs are formed sequentially, so that bit 7 and bit 6 are paired, bit 5 and bit 4 are paired, and so on.

Protecting Your Picture

When using BASIC and the bitmap modes together, BASIC may have a tendency to use the bitmap memory for program and/or variable storage. To prevent this, change addresses 55 and 56, the bytes which point to BASIC's end of memory. Simply change these to point to an address below the lowest address you use. Address 56 is equal to the last address used divided by 256, and address 55 is the remainder. After changing these two bytes, execute a CLR instruction. For example, this instruction insures that BASIC will not use any memory after address 23552:

```
POKE 55, 0:POKE 56, 92:CLR
```

To restore your 64 to normal operation, use the following commands:

```
POKE 53265,27:POKE 53270,200:POKE 53272,20:
  POKE 56576,151
```

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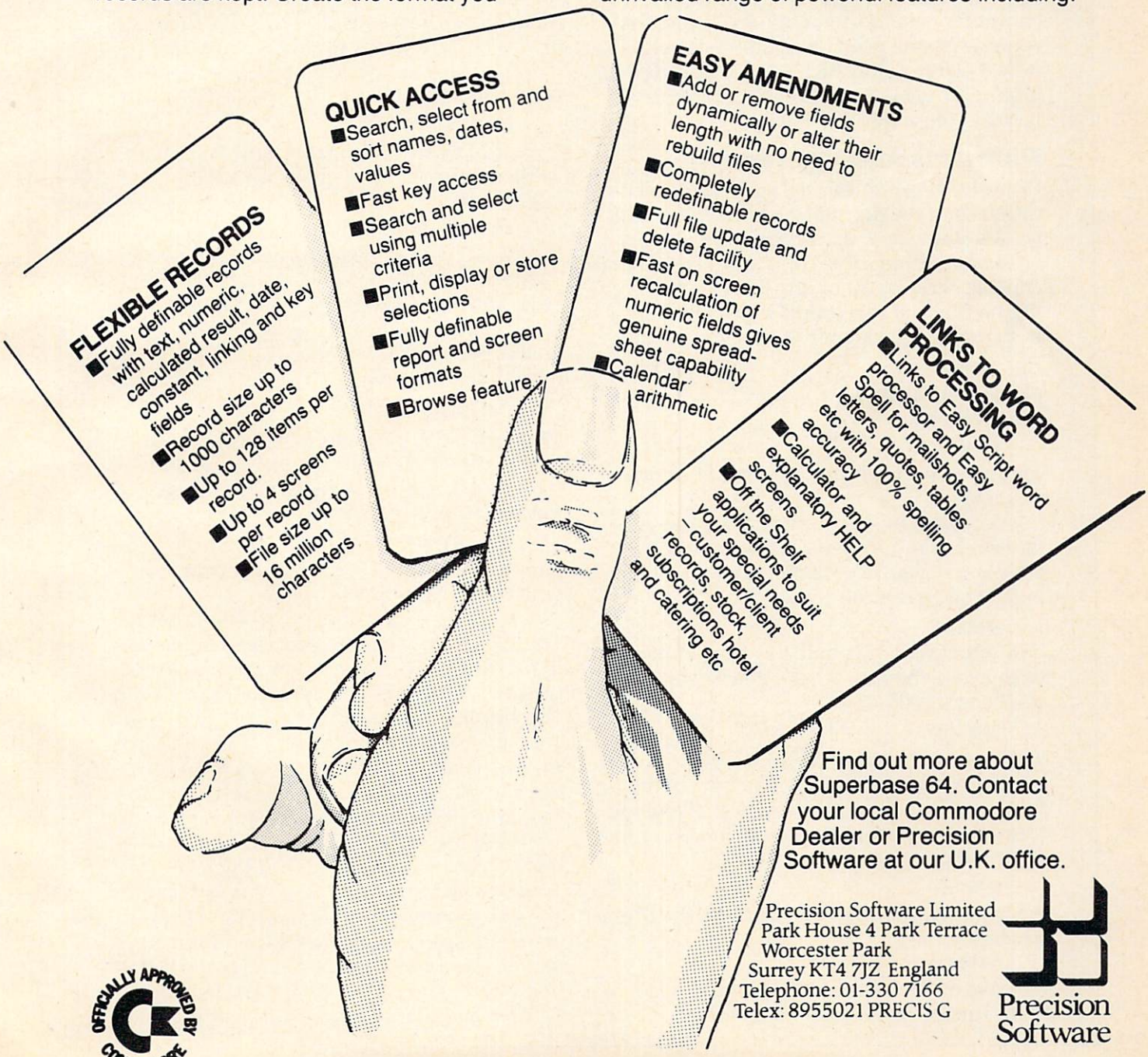

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BINARY AND BITMAPPING

Lance Elko, Assistant Editor

The Commodore 64's high-resolution graphics screen consists of 64,000 (320 by 200) dots or *pixels*. Each one can be turned on or off to let you create your own special graphics. This technique is called *bitmapping*.

At first glance, you might think that if there are 64,000 pixels to control, you'll need to use 64,000 memory cells (bytes) — but this would use more memory than you have available. With bitmapping, one byte controls not one, but *eight* pixels. Since there are eight bits (a bit is the smallest unit of storage in the computer's memory) in one byte, each bit represents one pixel on the hi-res screen. So, only 8,000 (roughly 8K) bytes are needed for bitmapping. Let's see how the computer handles these bits and bytes.

Filaments And Light Bulbs

Computers use the *binary* numbering system rather than the decimal system we're used to. A good way to understand how binary works is to think of a row of light bulbs, each capable of being on or off. The row has eight light bulbs and represents a byte; and each bulb represents one bit. If they are all off:

```
00000000
```

we have a value of zero. Now let's turn on the right one:

```
00000001
```

This gives us a value of 1. So far, it's not at all tricky.

The next bulb, counting from the right, however, has a somewhat different construction: It has two filaments. If just this bulb is on, it is indicated as:

```
00000010
```

but, remember, this bulb has *two* filaments, so the value here is 2. Let's go back and turn on the first bulb, also:

```
00000011
```

We now have a value of 3. Two bulbs are on, but three filaments are lit. The next bulb, the third from the right, contains *four* filaments (*twice* the number of the last bulb). So, if this is turned on:

```
00000100
```

we have a value of 4. If we turn on the previous bulbs:

```
00000111
```

we have 6 (4+2+1) filaments, but only 3 bulbs turned on. The binary value of 00000111, then, equals the decimal value of 6. We can see a pattern emerging here: Each bulb has twice the number of filaments as the one before it:

```
00000001=1      00010000=16
00000010=2      00100000=32
00000100=4      01000000=64
00001000=8      10000000=128
```

Converting Decimal To Binary

On/off combinations of these bulbs will yield any number between 0 and 255 (11111111). Let's pick a number, say 209, and figure out how to represent that number in binary. In other words, if we need exactly 209 filaments lit, which light bulbs should we turn on?

Since we can get 128 of them out of the way, let's do that first:

```
10000000 (128)
```

If we add the next available light bulb, with 64 filaments, that will get us up to 192 (128+64):

```
11000000 (192)
```

Now, we can't use the next bulb (with 32 filaments) because that would exceed our requirement of 209; so let's check the next one, 16. We can turn this one on because it would get us closer to our goal without going over (192+16=208):

```
11010000 (208)
```

We need only one more to make 209, and that's easy because there's only one bulb with one filament, the first one we discussed. Let's turn this one on:

```
11010001 (209)
```

and now we have 209 filaments turned on with only 4 light bulbs.

How does all this apply to bitmapping? The VIC-II chip, a microprocessor in the 64 that controls video display, scans an area of memory reserved exclusively for bitmapping. The chip reads each bit in every byte in this area, looking for 1s (on) and 0s (off). When a 1 is noted, the pixel it represents is turned on, and when a 0 is noted, the pixel remains the same as the background color.

Keeping in mind these points about binary numbers, take a look at Michael Tinglof's article to see how to control bits and bytes for effective bitmapping. He also discusses special commands used for manipulating the binary figures we discussed. You might find pages 121 – 28 in the *Commodore 64 Programmer's Reference Guide* helpful as well.

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A Graphics Demonstration

If all the computations needed to find the right bit seem complicated to you, and the two-color mode would be satisfactory, use the following utility program. It is written in machine language to increase speed, and can be used through X and Y coordinates. It is accessed from BASIC via the SYS command.

The format of the SYS call is as follows:

SYS (base address of code), command, operand(s)

The commands for the utility are as follows:

- 0 = clear bitmap page (set all bytes to 0)
- 1 = set screen color. Set all bytes in screen memory to the operand. For example, SYS(BS),1,32 sets every byte in screen memory to 32.
- 2 = set point. Set a given point according to its X and Y coordinates. Note that the upper-left corner is (0,0) and the bottom right is (319,199). For example, SYS(BS),2,28,122 sets point (28,122).
- 3 = clear point. The format is the same as above.

This machine language utility is relocatable and can be loaded into memory anywhere simply by changing the pointer in the BASIC loader. Before the utility can be used, however, addresses 680 and 681 must be set. Set address 680 to the start address of the bitmap divided by 256. Likewise, set address 681 to the start address of screen memory divided by 256. If you have set up the bitmap as shown in our working examples, use these POKEs:

```
POKE 680, 96:POKE 681, 92
```

To see how the utility and various aspects of bitmapped graphics work, look at the following program, which draws a sine curve on the screen.

Bitmapped graphics are a powerful part of the 64's repertoire. Once mastered, the results can be spectacular. Remember, the best way to learn is by hands-on practice. Once you feel comfortable with the techniques we've covered, try some of these ideas:

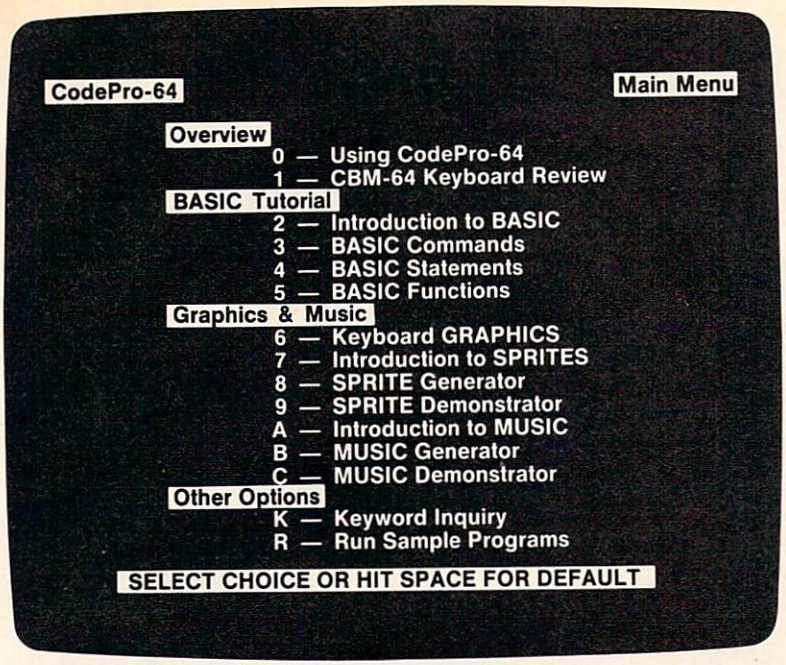
1. Draw the picture into memory, then switch the pointers to it. This makes the graphics appear lightning fast, even from BASIC.

2. Use several bitmaps and switch the pointers between them. Again, this gives the appearance of lightning fast graphics.

3. Use sprites. Since the sprites are totally independent of the background, you can create some fantastic graphics for games.

Sine Curve Graphics

```
3 REM{2 SPACES}COMMAND:
4 REM{5 SPACES}XX SYS (BASE),OPTION,DATA
5 REM{4 SPACES}OPTIONS:
6 REM SYS B, Ø{2 SPACES}-{2 SPACES}CLEAR
  {SPACE}SCREEN
7 REM SYS B, 1, CL - SET COLOR CL
8 REM SYS B, 2, X, Y - SET POINT (X,Y)
9 REM SYS B, 3, X, Y - CLEAR POINT
1Ø AD=32768:REM ** BASE ADDRESS
2Ø READD:IFD=-1THEN5ØØ:REM ** JUMP TO USE
  R ROUTINE
3Ø POKEAD,D:AD=AD+1:GOTO2Ø
1ØØ DATA 32, 115, Ø, 32, 158, 173, 32, 24
    7, 183, 14Ø, 17Ø, 2, 192, Ø
11Ø DATA 24Ø, 6, 192, 1, 24Ø, 32, 2Ø8, 77
    , 173, 168, 2, 133, 252, 24
12Ø DATA 1Ø5, 32, 133, 253, 169, Ø, 133,
    {SPACE}251, 168, 145, 251, 23Ø, 251,
    {SPACE}2Ø8
13Ø DATA 2, 23Ø, 252, 166, 252, 228, 253,
     144, 242, 96, 32, 115, Ø, 32
14Ø DATA 158, 173, 32, 247, 183, 132, 253
    , 173, 169, 2, 56, 233, 1, 133
15Ø DATA 252, 24, 1Ø5, 4, 133, 254, 169,
    {SPACE}8, 133, 251, 16Ø, 247, 165, 25
    3
16Ø DATA 145, 251, 23Ø, 251, 2Ø8, 2, 23Ø,
     252, 166, 252, 228, 254, 144, 242
17Ø DATA 96, 32, 115, Ø, 32, 158, 173, 32
    , 247, 183, 14Ø, 171, 2, 141
18Ø DATA 172, 2, 32, 115, Ø, 32, 158, 173
    , 32, 247, 183, 14Ø, 173, 2
19Ø DATA 152, 41, 248, 133, 253, 141, 18Ø
    , 2, 141, 174, 2, 169, Ø, 133
2ØØ DATA 254, 141, 181, 2, 162, 4, 24, 38
    , 253, 38, 254, 2Ø2, 16, 248
21Ø DATA 162, 2, 24, 46, 18Ø, 2, 46, 181,
     2, 2Ø2, 16, 246, 24, 165
22Ø DATA 253, 1Ø9, 18Ø, 2, 141, 178, 2, 1
    65, 254, 1Ø9, 181, 2, 141, 179
23Ø DATA 2, 173, 171, 2, 41, 248, 141, 17
    6, 2, 173, 172, 2, 141, 177
24Ø DATA 2, 56, 173, 173, 2, 237, 174, 2,
     24, 1Ø9, 176, 2, 133, 251
25Ø DATA 173, 177, 2, 1Ø9, 168, 2, 133, 2
    52, 24, 173, 178, 2, 1Ø1, 251
26Ø DATA 133, 251, 173, 179, 2, 1Ø1, 252,
     133, 252, 56, 173, 171, 2, 237
27Ø DATA 176, 2, 133, 253, 56, 162, 255,
    {SPACE}169, Ø, 1Ø6, 232, 228, 253, 2Ø
    8
28Ø DATA 25Ø, 141, 18Ø, 2, 174, 17Ø, 2, 2
    24, 3, 24Ø, 1Ø, 16Ø, Ø, 177
29Ø DATA 251, 13, 18Ø, 2, 145, 251, 96, 5
    6, 169, 255, 237, 18Ø, 2, 141
3ØØ DATA 18Ø, 2, 16Ø, Ø, 177, 251, 45, 18
    Ø, 2, 145, 251, 96,-1
5ØØ REM ** USER ROUTINE **
5Ø1 REM GRAPHS SINE CURVE
5Ø5 POKE 53265, PEEK(53265)OR2↑5:REM ** S
    ET BIT MAP MODE
51Ø POKE68Ø,96:POKE681,92:REM ** SET POIN
    TERS FOR UTILITY
515 POKE 53272, 12Ø:POKE 56576, 2:REM **
    {SPACE}SET UP VIC II MEMORY
52Ø POKE 55, Ø:POKE 56, 6Ø:CLR:REM ** PRO
    TECTS BIT MAP FROM BASIC PROGRAM
53Ø B=32768:REM ** SET BASE ADDRESS OF UT
    ILITY
54Ø SYS B,Ø: SYS B,1,16:REM ** CLEAR SCRE
    EN AND SET COLOR
55Ø FOR X=Ø TO 6 STEP .Ø5 :Y=SIN(X):REM *
```



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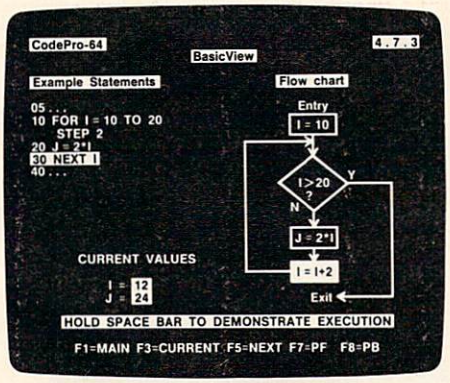

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CodePro-64's extensive tutorial guides you through each BASIC command, program statement, and function. You get clear explanations. Then you enter program statements as interactive examples. Where appropriate, you invoke BasicView to see examples execute and watch their flow charts and variables change.

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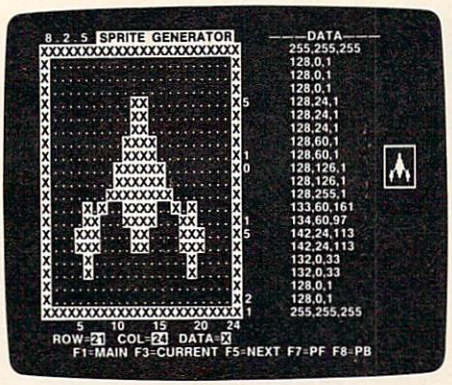
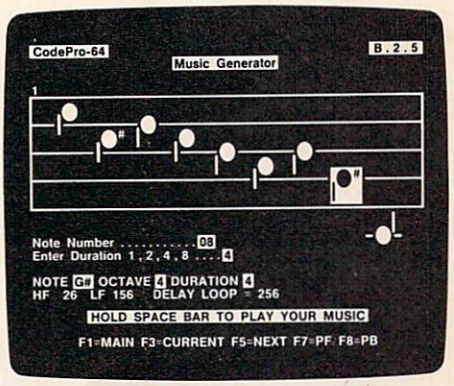
CodePro-64's sprite generator lets you **define your own sprites** on the screen. You learn how to define sprites and what data values correspond to your sprite definitions. (You can then use these values to write your own programs.) You can **easily experiment** with different definitions and make changes to immediately see the effects.



We also help you learn to program with sprites by giving you a **sprite demonstrator** so you can see the effect of changing register values. You can experiment by moving your sprite around in a screen segment, change its color or priority, and see the effects of your changes. You learn by visual examples.

MUSIC GENERATOR & DEMONSTRATOR

To teach you music programming CodePro-64 gives you an interactive music generator and demonstrator. First we help you set all your SID parameters (attack/decay, sustain/release, waveform, etc.). Then you enter notes to play and **we show your tune graphically as it plays,** note by note, on the scale. You learn by seeing and hearing the results of your input.



Our music demonstrator **lets you experiment** with various combinations of music programming parameters and hear the results. You can **quickly modify any of the SID register values** to hear the effects of the change. For example, you could easily change waveform and attack/decay values while holding all other SID values constant. By seeing your input and hearing the result you quickly learn how to create new musical sounds and special sound effects.

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```
    * GET VALUE FOR SINE CURVE
560 X1=X*50:Y=Y*50:REM ** ENLARGE GRAPH S
    IZE
570 Y=100-Y:SYS B,2,X1,Y:REM ** GRAPH POI
    NT
580 NEXT X:REM ** GRAPH NEXT
590 GOTO 590
600 REM ** EXIT WITH BREAK/RESTORE      ©
```


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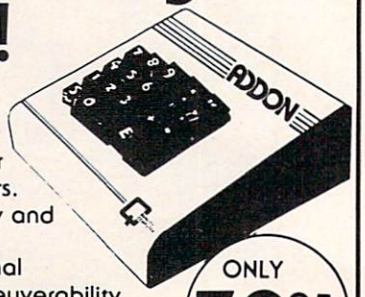

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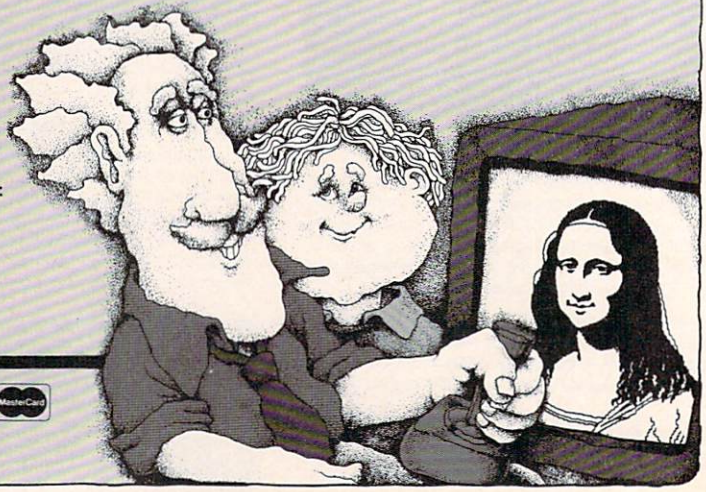

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Atari Screenbyter

Carl Zahrt and Orson Scott Card

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Atari home computers have superb graphics. Creating screen displays from BASIC, page flipping, scrolling, redefining characters, continuous memory, and changing from mode to mode to get exactly the effect you want – once you've worked with graphics on the Atari, some other home computers can seem a bit confining.

But that doesn't mean using Atari graphics is *easy*, especially if you want large displays which extend far beyond the edges of the TV screen, or detailed drawings that would take hundreds of PLOT and DRAWTO statements to create from BASIC. Such things take painstaking work on graph paper and many POKEs into screen memory – or a good chunk of your paycheck for software to do it for you.

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- You can work in any of the non-GTIA pixel modes.
- You have access to GRAPHICS 6.5 and 7.5, pixel modes that cannot be used with a simple GRAPHICS statement.
- You can type RUN and start drawing with the joystick – no programming experience is needed.
- You can fill in large areas quickly and easily.
- Since the main action of the program is in machine language, it moves very quickly, but a Slow Mode is provided so you can do detail work, pixel by pixel.
- You can change screen colors with the joystick.
- You aren't always limited by the size of the screen. In GRAPHICS 3 you can create scrolling displays many times larger than the TV screen, and all the modes except 7.5 and 8 allow some scrolling.
- When you save a display to disk, all the parameters – mode, size, and colors – are saved with the screen data, so that you can load them directly into your own programs.

Using Screenbyter

Setup. Screenbyter begins by displaying a directory of all files on the disk with the extender ".PIX". This extender is automatically added to all files created by Screenbyter. If no directory appears, there are no previously saved files on the disk.

"What file should hold your finished screen? (Eight characters)." Respond to this prompt by giving the filename you want your new display to have, when you save it at the end of the editing session. Screenbyter automatically removes everything before a colon or after a period and replaces it with "D1:" and ".PIX", so that you only need to enter the eight-letter filename. If you use illegal characters, Screenbyter will ask you to try again; if you use more than eight characters, only the first eight characters will be used.

If the name you enter is the name of a file already on disk, Screenbyter will remind you of that. To change the name, press RETURN. Or, if you want your new display to overwrite the old file, press any other key to go on.

"Would you like to edit a screen you have already saved? (Y or N)." If you answer *Y*, Screenbyter asks you for the name of the saved

file. If the file is not on disk in the form "D1:*filename*.PIX", Screenbyter will tell you and ask you to insert the correct disk or, if you wish, ask you again if you want to edit a previously saved screen.

Once the file is found, Screenbyter reads the first four bytes of the file to get the mode number, the number of bytes per line, and the number of lines in the display as it was saved. Press RETURN if you want to change these parameters. Press any other key to leave them the same.

Changing the parameters can have interesting effects. Remember that four-color modes all read the bytes the same way; if you want to draw your displays in GRAPHICS 3 (ANTIC 8) and then display them in a higher four-color mode, you can. Changing the length of a file either chops off the bottom or adds blank lines at the bottom of the display. Changing the line width, however, will usually result in garbage, since the vertical relationships will all be changed. The option is included, however, because sometimes even "garbage" can be fun.

If you are not editing a previously saved display, or if you are changing the parameters, you get the following series of prompts:

"What Antic mode will you work in?" This prompt is followed by a table that lists the eight ANTIC pixel modes and their graphics mode equivalent. ANTIC 8, for instance, is GRAPHICS 3; ANTIC F (15) is GRAPHICS 8. Two ANTIC modes, C (12) and E (14), have no GRAPHICS equivalent – they are the famous "GRAPHICS 6.5" and "GRAPHICS 7.5." (See Table 1.) Enter the ANTIC mode number: 8, 9, A, B, C, D, E, or F.

"How wide a line? (Minimum *nn* bytes, maximum *nn* bytes)." Depending on the mode you chose, Screenbyter will give you the minimum and maximum number of bytes per line. Remember that in the four-color modes, each byte is four pixels, while in the two-color modes, each byte is eight pixels. The minimum is based on the minimum number of bytes required to fill the screen. The maximum is based on the widest possible line that will allow the display to fit within 4K. If you enter numbers outside the legal range, Screenbyter will select the minimum or maximum, as appropriate.

With ANTIC *E* and *F*, the minimum and maximum are the same – you have no option, so any number you enter will result in the same number of bytes per line. This is because these two modes will not scroll – they both require more than 4K. Scrolling a screen that crosses a 4K boundary requires elaborate arrangements of screen memory that are beyond the scope of this program. Displays created in *E* and *F* will take up 65 sectors on disk; all other displays will take up 33 sectors or fewer.

Table 1: Atari Pixel Modes

ANTIC mode	8	9	A	B	C	D	E	F
Graphics mode	3	4	5	6	—	7	—	8
Colors	4	2	4	2	2	4	4	2
Resolution	24 x 40	48 x 80	48 x 80	96 x 160	192 x 160	96 x 160	192 x 160	192 x 320
Memory, bytes (sectors)	240 (3)	480 (5)	960 (9)	1920 (17)	3840 (33)	3840 (33)	7680 (65)	7680 (65)
Lines/screen	24	48	48	96	192	96	192	192
Bytes/line	10	10	20	20	20	40	40	40
Bits/pixel (Pixels/byte)	2 (4)	1 (8)	2 (4)	1 (8)	1 (8)	2 (4)	2 (8)	1 (4)
Scan lines/ pixel	8	4	4	2	1	2	1	1
Color clocks/ pixel	4	2	2	1	1	1	1	½

Note: ANTIC C and E, the two "hidden" pixel modes, provide the same resolution. All the other pixel modes attempt to create as square a pixel as the TV screen allows – the same number of color clocks wide as scan lines high. *C* and *E*, however, are twice as wide as they are high, making each pixel very short and wide. They come very near the resolution of ANTIC F (GRAPHICS 8). The advantages are that, compared to *F*, *C* uses half the memory and *E* allows four colors.

"How many lines do you want to edit? (Minimum *nn*, maximum *nn*)." The minimum and maximum depend on the mode and the number of bytes per line already selected. Again, if you choose parameters outside the legal range, Screenbyter will select the minimum or maximum. And if you choose the maximum number of bytes per line, only the minimum number of lines per screen will be possible.

When all selections have been made, you are given one last chance to change your mind. All the parameters you chose are displayed on the screen. If they are correct, press START, and the program will go on. If you want to make changes, press OPTION and the program will start over.

Waiting. What's going on while you wait? Screenbyter configures the memory to reserve 10K (40 pages) at the top of memory to hold screen memory (up to 8K), the display list, and the machine language routine that actually puts your drawing on the screen. Screen memory is cleared and the machine language routines are loaded. If you chose to edit a previously saved screen, it is loaded into memory now. All this takes about six seconds. The rest of the time is spent writing the display list. The higher the ANTIC mode, the longer it takes to write the display list – ANTIC F requires about 200 POKEs in BASIC, plus the calculations to find out what numbers to POKE, and it can take as long as 20 seconds.

When Screenbyter is ready for you to edit, there will be a cursor in the upper-left-hand corner.

Moving the cursor. The joystick controls the cursor.

Drawing a line. Hold down the joystick button to draw; let it up to move the cursor without drawing.

Selecting a color. Press 1 or SHIFT-CAPS/LOWR to select Color 1. Press 2 or CONTROL-CAPS/LOWR for Color 2. Press 3 or SHIFT-CONTROL-CAPS/LOWR for Color 3. Press 0 or CAPS/LOWR to select the background color. Drawing in the background color has the effect of erasing.

Color Mode. To change the actual colors that are displayed by Colors 1, 2, or 3, or the background color, press START. You will hear a buzz, and the cursor will no longer respond to the joystick. Instead, moving the joystick will change the colors displayed on the screen. Moving the joystick up or right will change the color from darker to brighter, then jump to the darkest value of the next color. Moving the joystick down or left will change the color from brighter to darker, then jump to the brightest value of the next color.

To change the background color, move the joystick forward or back; to change Color 3, move the joystick left or right. To change Color 2, move the joystick forward or back with the button pressed; to change Color 1, move the joystick left or right with the button pressed.

To return to Cursor Mode, press START again. No other commands will work during Color Mode.

Slow Mode. Press the space bar to enter Slow Mode. A delay loop in the program makes the cursor move much more slowly around the screen, with a click between moves. This mode allows you to create details. To return to Fast Mode, press the space bar again.

Fill Mode. Press the inverse key (Atari logo key) to enter Fill Mode. A low hum will come from the television. In this mode, when you press the joystick button, Screenbyter draws a dot of the selected color at the current cursor location, as usual, but it also searches to the right along the same line. If it finds another dot of the same color before it reaches the end of the line, it will fill in all the area between that dot and the current cursor position with dots of the same color. If no dot of the same color is found, no fill operation is performed.

This allows you to fill large or small areas of the screen with a single color. Simply draw the right-hand edge of the figure first; then enter Fill Mode and draw the left-hand border. It takes some practice to get used to using this function without accidentally erasing parts of your screen, but you may find that this can be the most useful feature of Screenbyter.

To exit Fill Mode, press the inverse key again. The hum will continue as long as you are in Fill Mode, and will stop only when you leave.

Insert a line. Press SHIFT-INSERT to insert a line at the current cursor position. The bottom line of the display will be pushed down and lost.

Delete a line. Press SHIFT-DELETE to delete the current cursor line. A blank line will be added at the bottom of the display.

Clear the screen. Press CONTROL-SHIFT-CLEAR to erase the screen completely. If you haven't already saved the display, it will be lost.

Saving the screen. Press SELECT to save the screen without ending the editing session. The current screen display will be saved as "D1:TEMPFILE.PIX". You can save as often as you like; Screenbyter will simply overwrite any existing TEMPFILE.PIX file.

Ending the editing session. Press OPTION to save the screen and end the editing session. (To exit without saving, press RESET.) The display will be saved as "D1:TEMPFILE.SCR." Then the regular GRAPHICS 0 screen will return and you will be given several prompts:

"Do you want to save the screen as D1:*filename*.PIX? (Y or N)." If you answer *N*, the saved display will be left as TEMPFILE.PIX. If you answer *Y*, Screenbyter will erase any existing file that has the same filename. Then Screenbyter will rename TEMPFILE.PIX with the filename you chose.

"Do you want to quit? (Y or N)." If you answer *Y*, Screenbyter will restore the old top of memory and exit to BASIC. If you answer *N*, you will get another prompt. To return to edit the screen you just left, press OPTION. That display will be reloaded into memory, the display list will be rewritten, and you can start over. To edit an entirely new screen, or to change the name of the save file, press START. In effect, Screenbyter will then start over.

What's Going On Inside The Program?

Like everything else in a computer, your display exists as a series of numbers stored in binary form in memory locations in the computer. The ANTIC chip scans screen memory as it is instructed to do by the display list. But it doesn't read the numbers as numbers. Instead, it reads them as patterns of "on" and "off" bits.

Four-color modes. In the four-color modes, each byte is read as code for four pixels. The eight-bit binary number is treated as four bit-pairs:

```
00 00 00 00
```

Each bit-pair provides the code for one pixel, or rectangle of color on the screen. In GRAPHICS 3,

each pixel is the size of a character in GRAPHICS 0. In GRAPHICS 7.5, each pixel is one scan line high and one color clock wide, which gives very good resolution. But all four-color modes read the bit-pairs the same way.

00 means to display the background color (the color code stored at location 712).

01 means to display Color 1 (the color code stored at location 708).

10 means to display Color 2 (the color code stored at location 709).

11 means to display Color 3 (the color code stored at location 710).

This means that the number 216 (binary 11011000) is treated as four pixel color instructions: The first pixel is Color 3, the second pixel is Color 1, the third pixel is Color 2, and the last pixel is the background color.

Two-color modes. The two-color modes treat each bit as a separate pixel instruction, so that each byte controls eight pixels. An "on" bit, or 1, is read as a Color 1 instruction, while an "off" bit, or 0, is read as a background color instruction. In a two-color mode, the number 216 would be treated as eight pixel color instructions: Two "on" pixels, one "off" pixel, two more "on" pixels, and three "off" pixels. (See Table 1 for a listing of all the modes.)

Moving around the screen. Moving the cursor around the screen, then, isn't simply a matter of moving from one byte to the next in screen memory. Screenbyter also has to move from bit to bit or from bit-pair to bit-pair within the bytes. This *can* be done in BASIC by adding or subtracting values, but it is very slow. Machine language, however, has powerful commands that make it easy to move from bit to bit. DRAWTO and PLOT commands do these manipulations for you, but since Screenbyter is circumventing the BASIC graphics commands entirely, there was no practical choice but to execute the main drawing operations in machine language.

To understand what Screenbyter is doing, you need to understand a few machine language commands: EOR, ORA, and AND. The two OR instructions and the AND instruction are not the same as the AND and OR you use in Atari BASIC. In machine language, these are operations on the bits of an eight-bit number, and are often called "bitwise" AND and OR to help keep the difference in mind.

AND, OR, EOR Explained

All three operations compare two numbers, one stored in the accumulator and another somewhere else in memory. The operation results in a third number, which is stored in the accumulator in place of the number that was already there.

- AND, referred to as "bitwise AND," compares the two numbers, bit by bit. Any bit that is on in both numbers *stays* on in the resulting number. All other bits are turned off. In other words, *only* bits that are on in the first number *and* in the second number remain on in the result.

```
          10010110
AND       11110000
results in 10010000
```

- ORA, referred to as "bitwise OR," compares the two numbers, but in this case any bit that is on in *either* number stays on in the result:

```
          10010110
ORA       11110000
results in 11110110
```

- EOR, referred to as "exclusive OR," compares the two numbers, and any bit that is on in one and *only* one number is left on in the result. Any bit that is on in both numbers or off in both numbers is off in the result:

```
          10010110
EOR       11110000
results in 01100110
```

How do these actually work, in practice?

Screenbyter maintains several *masks*. The Color Mask is in page 6, at memory location 1692. This byte is set from BASIC whenever the color is changed, and it is set so that every bit or bit-pair represents a pixel of the selected color. If the background color is selected, the Color Mask is 00000000. If Color 1 is selected, the Color Mask is 01010101. For Color 2, the Color Mask is 10101010, and for Color 3 it is 11111111. With two-color modes, the Color Mask is either 00000000 or 11111111.

The Cursor Mask is kept at location 1696. It is set to represent the current cursor pixel within the cursor byte. The bits in the current pixel are on; all others are off. In four-color modes, if the cursor is in the leftmost pixel of the cursor byte, the Cursor Mask will be set to 11000000; if it is in the rightmost pixel, the mask will be set to 00000011. The two middle pixels are 00110000 and 00001100. In two-color modes, a single "on" bit represents the cursor position.

Whenever you move the cursor left or right or diagonally, the Cursor Mask is shifted left or right, so that at any given moment, the Cursor Mask will mark which bit or bit-pair Screenbyter should change.

If you are drawing, Screenbyter first picks up the value of the current cursor byte and stores it at 1690. Then it picks up the Cursor Mask and EORs it with 11111111 (decimal 255). This reverses the Cursor Mask – any bit that was on is now off, and any bit that was off is now on.

Let's see that in action in a four-color mode,

in which the background is black, Color 1 is red, Color 2 is green, and Color 3 is blue. The bit-pairs will be separated in these examples, to make it easier to keep track of the pixels.

```
Cursor Mask  00 11 00 00
        EOR  11 11 11 11
results in   11 00 11 11    (Reverse Cursor Mask)
```

Screenbyter then ANDs the Reverse Cursor Mask with the number at 1690, which in effect makes a hole in the cursor position:

```
Reverse Cursor Mask  11 00 11 11
                AND  01 01 01 11  red   red   red   blue
         results in  01 00 01 11  red   —     red   blue
```

The two bits in the cursor position will *always* be turned off.

Now Screenbyter must prepare the pixel code to go in that hole. Screenbyter picks up the Cursor Mask and ANDs it with the Color Mask. Since all the bits in the Cursor Mask are off except the two bits of the current pixel, the resulting number will have only the bits that represent the current color, and only in the pixel position:

```
      Cursor Mask  00 11 00 00
AND Color Mask     10 10 10 10  green green green green
      results in   00 10 00 00  —     green —     —
```

Now we are ready to put the correct pixel code into the hole in the current cursor byte. To do this, we bitwise OR the current pixel we just got with the cursor byte with a hole in it from the operation before. Remember that with ORA, any byte that is on in either or both of the two numbers is on in the result:

```
    correct pixel  00 10 00 00  —     green —     —
ORA current byte
         with hole  01 00 01 11  red   —     red   blue
      results in    01 10 01 11  red   green red   blue
```

The result is then stored in 1690, and later in the program it is put into screen memory.

If you are not drawing (merely moving the cursor) the operation is a little different, but AND, EOR, and ORA perform the same functions.

Machine language is so fast that all this seems to happen instantaneously. In fact, the only reason the cursor doesn't fly around the screen out of control is because Screenbyter keeps leaving the machine language routine, returning to BASIC to check the keyboard for other commands. Even so, the cursor moves so quickly that it has to be slowed down in order to allow you to draw details.

Use of Page 6. The machine language routine at SCROLL uses a field in Page 6 to hold some important variables. The memory locations in Page 6 are explained in Table 2.

Table 2: Page 6 Locations

1670	WIDE-1. Used to check for the end of the logical line.
1671	Used in fill routine to keep track of right border of fill.
1672	Cursor location: current byte on logical line.
1673	Used by the fill routine to hold the pattern of the rightmost byte of the fill line.
1674-1675	LINE-1. Used to check for last line of display.
1676-1677	Cursor location: current logical line number.
1678	Bytes per screen line-1. Used by the scrolling routine to check for the end of the screen line.
1679	Cursor location: Current byte on screen line.
1680	Lines per screen-1. Used by the scrolling routine to check for the bottom of the screen display.
1681	Cursor location: current screen line number.
1682	Used by the fill routine to hold the pattern of the leftmost byte of the fill line.
1683	A temporary holding location.
1684	Used by the fill routine to hold the real value of the byte currently being tested.
1685	A temporary holding location.
1686-1687	The current screen starting address (the address of the upper-left-hand corner of the screen).
1688-1689	Cursor location: the address of the current cursor byte in screen memory.
1690	The real contents of the current cursor byte.
1691	The reverse (cursor display) contents of the current cursor byte.
1692	Color Mask.
1693	The number of bits per pixel (1 or 2).
1694	Scroll flag (0=do not scroll).
1695	Fill flag (0=do not fill).
1696	Cursor Mask.
1697	Joystick value.
1698	Total number of lines per screen. Used in the scroll routine to change the correct number of LMS instructions in the display list.
1699	WIDE. Used in the scroll routine to increment the LMS addresses in the display list.
1700	Fill Test Mask. Used in the fill routine to isolate and test each pixel until a pixel of the selected color is found.
1701	Starting Fill Test Mask. Either 192 (four-color mode) or 128 (two-color mode).
1702-1704	Machine language jump vector: JMP followed by the address of the fill subroutine held in the string FILL$.

Screenbyter Displays In Your Own Programs

Here are two routines you can add to your own programs, which will allow you to load the displays you created with Screenbyter. The first routine, Load and Display List, works with any Screenbyter file. However, it sets up a custom display list with individual LMS instructions, suitable for scrolling. This makes the setup time rather long. So a Simple Load Routine is also included. It will work with any display file that was created using the *minimum* line width and number of lines per screen, except screens created in ANTIC C and E (GRAPHICS 6.5 and 7.5). You cannot use it if you intend to scroll horizontally. However, you *can* use it if you intend to scroll vertically or flip pages, and if your display was created with the minimum line width.

Both routines will configure memory to protect the screen display, read the display parameters from whatever display file you choose, and load the file into memory. It uses a load routine very similar to the one used by Fontbyter, so we won't explain them again here.

Notice that in loading displays created in ANTIC E and F (GRAPHICS 7.5 and 8), the screen display must cross a 4K boundary line. The ANTIC chip gets fussy at this point, and ignores anything after a 4K boundary line until the beginning of the line pointed to by the next LMS instruction. Therefore, screen memory must be arranged so that the 4K boundary line comes right at the end of a line; the display list routine will have set the value of SC, the start of screen memory, so that the 4K boundary line will fall right at the end of a line.

Program 1: Load And Display List Routine

```
5 CLR :DIM PPB(7),BPL(7),MXW(7),LPS(
  7),FL$(20):FL$="D1:SHIP.PIX":GOSUB
   4000
4000 FOR I=0 TO 7:READ W,N,C,T:PPB(I
     )=W:BPL(I)=N:MXW(I)=C:LPS(I)=T:
     NEXT I
4005 A=PEEK(106):TOP=A-36:SP=TOP+4:S
     C=SP*256:DL=256*TOP:POKE 106,TO
     P:GRAPHICS 0:PRINT "{CLEAR}"
4010 X=16:ICCOM=834:ICBADR=836:ICBLE
     N=840:SCON=PEEK(559):K4=4096
4015 OPEN #1,4,0,FL$:GET #1,M:M8=M-8
     :GET #1,WIDE:GET #1,LLO:GET #1,
     LHI:LINE=LLO+256*LHI:SZ=WIDE*LI
     NE
4020 FOR I=708 TO 711:GET #1,N:POKE
     I,N:NEXT I:POKE I,N
4025 SC=SC+((LINE*WIDE)>K4)*(K4-INT(
     K4/WIDE)*WIDE):SH=INT(SC/256):S
     L=SC-256*SH
4030 FOR I=0 TO 2:POKE DL+I,112:NEXT
      I:N=0
4035 FOR I=DL+3 TO DL+3*LPS(M8) STEP
      3:C=SC+N*WIDE:POKE I,64+M:T=IN
     T(C/256)
4040 POKE I+2,T:POKE I+1,C-256*T:N=N
     +1:NEXT I
4045 POKE I,65:POKE I+1,0:POKE I+2,D
     L/256
4050 POKE 560,0:POKE 561,DL/256
4055 POKE ICBADR+X+1,SH:POKE ICBADR+
     X,SL:POKE ICBLEN+X+1,1+INT(SZ/2
     56):POKE ICBLEN+X,0
4060 POKE ICCOM+X,7:I=USR(ADR("hhh■L
     V■"),X):CLOSE #1:RETURN
4065 DATA 2,10,170,24,1,10,85,48,2,2
     0,85,48,1,20,42,96
4070 DATA 1,20,21,192,2,40,42,96,2,4
     0,40,192,1,40,40,192
```

Program 2: Simple Load Routine

```
5 CLR :DIM GM(15),FL$(20):FL$="D1:G8
  .PIX":GOSUB 4000
6 FOR I=0 TO 30000:NEXT I
4000 FOR I=0 TO 15:READ N:GM(I)=N:NE
     XT I
4005 A=PEEK(106):TOP=A-36:SP=TOP+4:S
     C=SP*256:DL=256*TOP:POKE 106,TO
     P:GRAPHICS 0:PRINT "{CLEAR}"
4010 X=16:ICCOM=834:ICBADR=836:ICBLE
     N=840:SCON=PEEK(559):K4=4096
4015 OPEN #1,4,0,FL$:GET #1,M:GET #1
     ,WIDE:GET #1,LLO:GET #1,LHI:LIN
     E=LLO+256*LHI:SZ=WIDE*LINE
4020 FOR I=708 TO 711:GET #1,N:POKE
     I,N:NEXT I:POKE I,N
4025 SC=SC+((LINE*WIDE)>K4)*(K4-INT(
     K4/WIDE)*WIDE):SH=INT(SC/256):S
     L=SC-256*SH
4030 GRAPHICS GM(M)+16:IF GM(M)=0 TH
     EN ? "INVALID MODE":RETURN
4035 DL=PEEK(560)+256*PEEK(561):DL4=
     DL+4:DL5=DL+5:POKE DL4,SL:POKE
     DL5,SH
4055 POKE ICBADR+X+1,SH:POKE ICBADR+
     X,SL:POKE ICBLEN+X+1,1+INT(SZ/2
     56):POKE ICBLEN+X,0
4060 POKE ICCOM+X,7:I=USR(ADR("hhh■L
     V■"),X):CLOSE #1:RETURN
4065 DATA 0,0,0,0,0,0,0,0,3,4,5,6,0,
     7,0,0
```

Program: Screenbyter

After the main listing of the BASIC program, you will find several programs to create disk files containing the machine language routines used in Screenbyter. If you prefer, you can easily add these DATA statements to your program and read them that way, or – as we prefer to do – load them into string constants and use them that way, without so many disk accesses. However, typing in strings that have lots of inverse and control characters in them can be tedious and often leads to typing errors, so these DATA statements are necessary in the published version of the program.

If you are also using "Fontbyter" (COMPUTE!, September 1983), you might notice that Screenbyter follows the same structure. That's because Fontbyter was used as the starting point, and changed wherever Screenbyter's needs were different. However, the line insert, line delete, and clear screen machine language routines are *not* identical, so don't try to use the similar Fontbyter routines for Screenbyter – you will hopelessly confuse your Atari if you do, and confused Ataris have unpleasant ways to express their frustration.

Program 3: Screenbyter

```
5 DIM FSAVE$(20),FLOAD$(20),FL$(40),
  FLL$(20),DELETE$(118),EXPAND$(102)
  ,N$(13),FILL$(230),CLEAR$(26)
10 DIM PPB(7),BPL(7),MXW(7),LPS(7),C
   OL(11),CL(3)
15 A=PEEK(106):TOP=A-40:SP=TOP+8:SC=
   SP*256:DL=256*TOP:SCROLL=DL+600:P
   OKE 106,TOP
20 X=16:ICCOM=834:ICBADR=836:ICBLEN=
   840:GRAPHICS 0:SCON=PEEK(559):F=1
```

```
   670:K4=4096:N$="No equivalent"
25 C=707:FOR I=0 TO 7:IF I/2=INT(I/2
   ) THEN C=C+1:IF C=711 THEN C=712
30 COL(I)=C:NEXT I:CL(0)=0:CL(1)=85:
   CL(2)=170:CL(3)=255:FMS=ADR("hhh■
   LV■")
35 RESTORE 770:FOR I=0 TO 7:READ W,N
   ,C,T:PPB(I)=W:BPL(I)=N:MXW(I)=C:L
   PS(I)=T:NEXT I:POKE 16,112:GOTO 3
   15
40 OPEN #1,4,0,FL$:GET #1,MD:GET #1,
   WD:GET #1,LLO:GET #1,LHI:LN=LLO+2
   56*LHI:SZ=WD*LN
45 FOR I=0 TO 6 STEP 2:GET #1,N:POKE
    COL(I),N:NEXT I
50 POKE ICBADR+X+1,SH:POKE ICBADR+X,
   SL:POKE ICBLEN+X+1,1+INT(SZ/256):
   POKE ICBLEN+X,0
55 POKE ICCOM+X,7:I=USR(FMS,X):CLOSE
    #1:RETURN
60 OPEN #1,8,0,"D1:TEMPFILE.PIX":PUT
    #1,M:PUT #1,WIDE:PUT #1,LLO:PUT
   #1,LHI
65 FOR I=0 TO 6 STEP 2:PUT #1,PEEK(C
   OL(I)):NEXT I:POKE PEEK(1688)+256
   *PEEK(1689),PEEK(1690)
70 POKE ICBADR+X+1,SH:POKE ICBADR+X,
   SL:POKE ICBLEN+X+1,1+INT((LINE*WI
   DE)/256):POKE ICBLEN+X,0
75 POKE ICCOM+X,11:I=USR(FMS,X):CLOS
   E #1:RETURN
80 IF ((LINE*WIDE-PIX)<WIDE) THEN RE
   TURN
85 C=USR(ADR(DELETE$)):POKE 1690,PEE
   K(PEEK(1688)+256*PEEK(1689)):POKE
    53279,4:ON SPEED GOSUB 740:RETUR
   N
90 IF ((LINE*WIDE-PIX)<WIDE) THEN RE
   TURN
95 T=SC+WIDE*LINE-WIDE-1:C=INT(T/256
   ):T=T-256*C:POKE 205,T:POKE 206,C
100 POKE (PEEK(1688)+256*PEEK(1689))
   ,PEEK(1690)
105 C=USR(ADR(EXPAND$)):POKE 1690,0:
   POKE 53279,4:ON SPEED GOSUB 740:
   RETURN
110 POKE 1690,PEEK(SC):POKE 1691,121
   :POKE 559,SCON:OPT=8
115 OPT=PEEK(53279):IF OPT=6 THEN GO
   SUB 180:GOTO 115
120 N=PEEK(632):C=USR(SCROLL,N):IF N
   <15 THEN POKE 77,0:IF SPEED THEN
    GOSUB 740:POKE 53279,4
125 IF PEEK(753)=3 THEN GOSUB 140:GO
   TO 115
130 ON OPT=3 GOTO 550:IF OPT=5 THEN
   GOSUB 60:GOTO 115
135 GOTO 115
140 GOSUB 635:ON (C=116)+2*(C=119)+3
   *(C=246) GOTO 80,90,170
145 IF N=60 THEN C=C-59:SHIF=INT(C/6
   4):GOSUB 725
150 IF C=31 OR C=30 OR C=26 OR C=50
   THEN GOSUB 720
155 IF N=33 THEN SPEED=1*(SPEED=0):G
   OSUB 715
160 IF N=39 THEN VERS=255*(VERS=0):P
   OKE 1695,VERS:GOSUB 735
165 RETURN
170 C=USR(ADR(CLEAR$),SP):POKE 1690,
   0:POKE 1691,PEEK(1696):RETURN
175 GOSUB 715:RETURN
180 GOSUB 715
185 DI=PEEK(632):T=PEEK(644):DI=DI+5
   *(DI=7):DI=DI-11:OPT=PEEK(53279)
   :IF OPT=6 THEN 175
190 IF DI<0 OR DI>3 THEN 185
195 DI=4*T+DI:IF DI/2=INT(DI/2) THEN
    POKE COL(DI),PEEK(COL(DI))-2+25
   6*(PEEK(COL(DI))<2):GOTO 185
200 POKE COL(DI),PEEK(COL(DI))+2-256
   *(PEEK(COL(DI))>253):GOTO 185
205 FLL$=FL$:FOR I=1 TO LEN(FL$):N=A
   SC(FL$(I,I)):ON N=58 GOSUB 245:N
   EXT I:FL$=FLL$
210 FLL$=FL$:FOR I=1 TO LEN(FL$):N=A
   SC(FL$(I,I)):ON N=46 GOSUB 250:N
   EXT I:FL$=FLL$
215 IF LEN(FL$)>8 THEN FL$=FL$(1,8)
220 IF LEN(FL$)<1 THEN 265
225 N=ASC(FL$(1,1)):IF N>90 OR N<65
   THEN 260
230 IF LEN(FL$)<2 THEN GOTO 240
235 FOR I=2 TO LEN(FL$):N=ASC(FL$(I,
   I)):ON (N>90 OR N<65) AND (N>57
   OR N<48) GOTO 255:NEXT I
240 FLL$="D1:":FLL$(4)=FL$:N=0:RETURN
245 FLL$=FL$(I+1,LEN(FL$)):RETURN
250 FLL$=FL$(1,I-1):RETURN
255 POP :? "{CLEAR}":? "Illegal char
   acters in ";FL$:GOTO 265
260 ? "{CLEAR}":? FL$;" must start w
   ith a capital":? "letter.":GOTO
   265
265 ? "Let's try that name again.":N
   =1:RETURN
270 TRAP 275:OPEN #1,4,0,FL$:N=0:CLO
   SE #1:RETURN
275 ? :? FL$;" isn't on disk in":? "
   drive 1":? "Insert disk with ";F
   L$;"and":? "press RETURN.":CLOSE
    #1
280 ? "Or to try another file name,
   press anyother key."
285 ON PEEK(753)<>3 GOTO 285:GOSUB 6
   35:ON N=12 GOTO 270:N=1:RETURN
290 TRAP 310:OPEN #1,4,0,FL$:? FL$;"
    is already on disk.":? "Unless
   you change the name, the old"
295 ? "file will be lost.  To change
    the namepress RETURN":? "Or pre
   ss any other key to continue.":C
   LOSE #1
300 ON PEEK(753)<>3 GOTO 300:GOSUB 6
   35:ON N=12 GOTO 305:N=0:RETURN
305 N=1:RETURN
310 CLOSE #1:N=0:RETURN
315 ? "{CLEAR}{12 SPACES}screenbyter"
   :? :? :?
320 GOSUB 695:? :? "What file should
    hold your finished{3 SPACES}scr
   een? (Eight characters)":POKE 76
   4,255:INPUT FSAVE$
325 FL$=FSAVE$:GOSUB 205:ON N GOTO 3
   20:FSAVE$=FLL$:FSAVE$(LEN(FLL$)+
   1)=".PIX"
330 FL$=FSAVE$:GOSUB 290:ON N GOTO 3
   20
335 FLOAD$="":? :? "Would you like t
   o edit a screen you{3 SPACES}hav
   e already saved? (Y or N) "
340 GOSUB 635:ON N=35 GOTO 390:ON N=
```

```
    43 GOTO 345:GOTO 340
345 ? :? "What is the name of the sa
    ved screen  file? ":POKE 764,255
    :INPUT FLOAD$
350 FL$=FLOAD$:GOSUB 205:ON N=0 GOTO
     355:GOTO 335
355 FLOAD$=FLL$:FLOAD$(LEN(FLL$)+1)=
    ".PIX"
360 FL$=FLOAD$:GOSUB 270:ON N GOTO 3
    35:OPEN #1,4,0,FLOAD$:GET #1,MD:
    GET #1,WD:GET #1,LLO:GET #1,LHI
365 CLOSE #1:FLOAD=1:LN=LLO+256*LHI
370 ? :? FLOAD$;" was saved as:":? "
    Mode ";MD;",":? "with ";LN;" lin
    es":? "of ";WD;" characters per
    line."
375 ? "If you wish to change these p
    arameterspress RETURN.":? "To le
    ave them unchanged press any
    {5 SPACES}other key."
380 ON PEEK(753)<>3 GOTO 380:GOSUB 6
    35:IF N=12 THEN 395
385 M=MD:M8=M-8:WIDE=WD:LINE=LN:GOTO
     445
390 FLOAD=0
395 ? :? "What Antic mode will you w
    ork in?":? :? "Antic","Graphics"
    :? 8,3:? 9,4:? "A (10)",5:? "B (
    11)",6
400 ? "C (12)",N$:? "D (13)",7:? "E
    (14)",N$:? "F (15)",8:POKE 764,2
    55
405 TRAP 405:OPEN #1,4,0,"K:":GET #1
    ,N:CLOSE #1:ON N<56 OR (N>57 AND
     N<65) OR N>70 GOTO 405
410 M=N-48:M=M-7*(M>9):M8=M-8
415 ? :? "How wide a line?":? "  (Mi
    nimum ";BPL(M8);" bytes":? "
    {3 SPACES}maximum ";MXW(M8);" by
    tes)"
420 POKE 764,255:TRAP 420:INPUT WIDE
    :WIDE=INT(WIDE):GOSUB 640:GOSUB
    745
425 ? :? "How many lines do you want
     to edit?":? "(Minimum ";LPS(M8)
    ;", Maximum ";MXL;")"
430 TRAP 430:INPUT LINE
435 LINE=INT(LINE):ON LINE<=MXL AND
    LINE>=LPS(M8) GOTO 440:LINE=MXL*
    (LINE>MXL)+LPS(M8)*(LINE<LPS(M8)
    )
440 LHI=INT(LINE/256):LLO=LINE-256*L
    HI
445 ? "{CLEAR}":? "You have chosen:"
    :? "Save file--";FSAVE$:? "Load
    file--";FLOAD$
450 ? "Mode ";M:? LINE;" lines of ";
    WIDE;" characters"
455 ? "If this is right, press START
    {9 SPACES}To make changes, press
     OPTION"
460 ON (PEEK(53279)=6)+(2*(PEEK(5327
    9)=3)) GOTO 465,315:GOTO 460
465 ? "{CLEAR}Just a minute while I
    get myself{6 SPACES}together . .
    ."
470 SC=SC+((LINE*WIDE)>K4)*(K4-INT(K
    4/WIDE)*WIDE):SH=INT(SC/256):SL=
    SC-256*SH
475 POKE 1670,WIDE-1:POKE 1674,LLO-1
    +256*(LLO=0):POKE 1675,LHI-(LLO=
    255)
480 POKE 1678,BPL(M8)-1:POKE 1680,LP
    S(M8)-1:POKE 1692,CL(3):POKE 169
    3,PPB(M8):POKE 1698,LPS(M8):POKE
     1699,WIDE
485 GOSUB 755:GOSUB 490:GOSUB 505:GO
    SUB 650:GOSUB 530:ON FLOAD GOSUB
     500:GOTO 110
490 OPEN #1,4,0,"D1:CLEARS.SUB":FOR
    I=1 TO 26:GET #1,N:CLEAR$(I,I)=C
    HR$(N):NEXT I:CLOSE #1
495 C=USR(ADR(CLEAR$),SP):RETURN
500 T=SZ:FL$=FLOAD$:GOSUB 40:SZ=T:RE
    TURN
505 DL4=DL+4:DL5=DL+5:FOR I=0 TO 2:P
    OKE DL+I,112:NEXT I:C=INT(SC/256
    ):N=SC-C*256
510 FOR I=1686 TO 1688 STEP 2:POKE I
    ,N:POKE I+1,C:NEXT I:N=0
515 FOR I=DL+3 TO DL+3*LPS(M8) STEP
    3:C=SC+N*WIDE:POKE I,64+M:T=INT(
    C/256)
520 POKE I+2,T:POKE I+1,C-256*T:N=N+
    1:NEXT I
525 POKE I,65:POKE I+1,0:POKE I+2,DL
    /256:RETURN
530 OPEN #1,4,0,"D:SCROLL.SUB":N=INT
    (SCROLL/256):C=SCROLL-256*N
535 POKE ICBADR+X+1,N:POKE ICBADR+X,
    C:POKE ICBLEN+X+1,3:POKE ICBLEN+
    X,0
540 POKE ICCOM+X,7:I=USR(FMS,X):CLOS
    E #1
545 POKE 560,0:POKE 561,DL/256:CLOSE
     #1:RETURN
550 POKE PEEK(1688)+256*PEEK(1689),P
    EEK(1690):GOSUB 60:GRAPHICS 0:PO
    KE 764,255
555 ? "Screen is saved as D1:TEMPFIL
    E.SCR":? :? "Do you want to save
     the screen as":? FSAVE$;"? (Y o
    r N)"
560 GOSUB 635:ON N<>43 AND N<>35 GOT
    O 560:IF N=43 THEN GOSUB 610:GOT
    O 570
565 FSAVE=0
570 ? :? "Do you want to quit? (Y or
     N)":POKE 764,255
575 GOSUB 635:ON N<>43 AND N<>35 GOT
    O 575:ON N=35 GOTO 580:ON N=43 G
    OTO 605
580 ? :? "To return to edit the same
     screen,{4 SPACES}press OPTION":
    ? :? "To start SCREENBYTER over,
     press START"
585 OPT=PEEK(53279):ON ((OPT=6)+(2*(
    OPT=3))) GOTO 590,595:GOTO 585
590 POKE 106,A:GRAPHICS 0:GOTO 20
595 POKE 106,TOP:FL$="D1:TEMPFILE.PI
    X":IF FSAVE=1 THEN FL$=FSAVE$
600 GOSUB 755:GOSUB 40:GOSUB 505:POK
    E 560,0:POKE 561,DL/256:GOTO 110
605 POKE 106,A:POKE 764,255:GRAPHICS
     0:END
610 FSAVE=1:TRAP 615:OPEN #2,4,0,FSA
    VE$:CLOSE #2:XIO 36,#2,0,0,FSAVE
    $:XIO 33,#2,0,0,FSAVE$:GOTO 620
615 CLOSE #2
620 FL$="D1:TEMPFILE.PIX,":FLL$=FSAV
    E$(4,LEN(FSAVE$)):FL$(17)=FLL$
625 XIO 32,#1,0,0,FL$:RETURN
```

```
630 ON PEEK(753)<>3 GOTO 630:RETURN
635 C=PEEK(764):N=C-64*INT(C/64):RET
    URN
640 IF WIDE>=BPL(M8) AND WIDE<=MXW(M
    8) THEN RETURN
645 WIDE=MXW(M8)*(WIDE>MXW(M8))+BPL(
    M8)*(WIDE<BPL(M8)):RETURN
650 OPEN #1,4,0,"D:DELETES.SUB":FOR
    I=1 TO 118:GET #1,N:DELETE$(I,I)
    =CHR$(N):NEXT I:CLOSE #1
665 OPEN #1,4,0,"D:EXPANDS.SUB":FOR
    I=1 TO 102:GET #1,N:EXPAND$(I,I)
    =CHR$(N):NEXT I:CLOSE #1
680 OPEN #1,4,0,"D:FILL.SUB":FOR I=1
     TO 230:GET #1,N:FILL$(I,I)=CHR$
    (N):NEXT I
690 CLOSE #1:C=ADR(FILL$):N=INT(C/25
    6):C=C-N*256:POKE 1702,76:POKE 1
    703,C:POKE 1704,N:RETURN
695 TRAP 710:XIO 36,#1,0,0,"D1:*.PIX
    "
700 ? :? "Currently saved screen fil
    es:"
705 FL$="D1:*.PIX":OPEN #1,6,0,FL$:F
    OR I=0 TO 50:INPUT #1,FLL$:? FLL
    $:NEXT I
710 CLOSE #1:RETURN
715 FOR I=0 TO 10:POKE 53279,4:NEXT
    I:RETURN
720 SHIF=(C=31)+2*(C=30)+3*(C=26)
725 POKE 53279,4:POKE 1692,CL(SHIF):
    IF PPB(M8)=1 AND SHIF>0 THEN SHI
    F=3:POKE 1692,CL(SHIF)
730 RETURN
735 N=(VERS=255):SOUND 0,200*N,14*N,
    4*N:RETURN
740 FOR I=0 TO 10:NEXT I:RETURN
745 IF BPL(M8)=MXW(M8) THEN MXL=LPS(
    M8):RETURN
750 MXL=INT(K4/WIDE):RETURN
755 FOR I=1677 TO 1681 STEP 2:POKE I
    ,0:NEXT I:FOR I=1686 TO 1688 STE
    P 2:POKE I,SL:POKE I+1,SH:NEXT I
760 N=128+64*(PPB(M8)=2):POKE 1696,N
    :POKE 1701,N
765 POKE 1672,0:POKE 1676,0:VERS=0:G
    OSUB 735:POKE 1695,VERS:RETURN
770 DATA 2,10,170,24,1,10,85,48,2,20
    ,85,48,1,20,42,96
775 DATA 1,20,21,192,2,40,42,96,2,40
    ,40,192,1,40,40,192
```

Program 4: Insert Line Routine

```
900 OPEN #1,8,0,"D1:EXPANDS.SUB"
910 FOR I=1 TO 102:READ N:PUT #1,N:N
    EXT I:CLOSE #1:? I:END
1000 DATA 104,56,165,205,237,163,6,1
     33
1008 DATA 203,165,206,233,0,133,204,
     56
1016 DATA 173,138,6,237,140,6,133,20
     7
1024 DATA 173,139,6,237,141,6,133,20
     8
1032 DATA 165,208,240,5,162,255,24,1
     44
1040 DATA 2,166,207,172,163,6,177,20
     3
1048 DATA 145,205,136,208,249,202,24
     0,31
1056 DATA 56,165,205,237,163,6,133,2
     05
1064 DATA 165,206,233,0,133,206,56,1
     65
1072 DATA 203,237,163,6,133,203,165,
     204
1080 DATA 233,0,133,204,24,144,212,1
     65
1088 DATA 208,208,206,172,163,6,169,
     0
1096 DATA 145,203,136,208,251,96
```

Program 5: Delete Line Routine

```
900 OPEN #1,8,0,"D1:DELETES.SUB"
910 FOR I=1 TO 118:READ N:PUT #1,N:N
    EXT I:CLOSE #1:? I:END
1000 DATA 104,56,173,152,6,237,136,6
1008 DATA 133,203,173,153,6,233,0,13
     3
1016 DATA 204,24,165,203,109,163,6,1
     33
1024 DATA 205,165,204,105,0,133,206,
     56
1032 DATA 173,138,6,237,140,6,133,20
     7
1040 DATA 173,139,6,237,141,6,133,20
     8
1048 DATA 165,208,240,5,162,255,24,1
     44
1056 DATA 2,166,207,172,163,6,177,20
     5
1064 DATA 145,203,136,208,249,202,24
     0,31
1072 DATA 24,165,205,109,163,6,133,2
     05
1080 DATA 165,206,105,0,133,206,24,1
     65
1088 DATA 203,109,163,6,133,203,165,
     204
1096 DATA 105,0,133,204,24,144,212,1
     65
1104 DATA 208,208,206,172,163,6,169,
     0
1112 DATA 145,205,136,208,251,96
```

Program 6: Cursor Movement Routine

```
900 OPEN #1,8,0,"D1:SCROLL.SUB"
910 FOR I=1 TO 650:READ N:PUT #1,N:N
    EXT I:CLOSE #1:? I:END
1000 DATA 104,104,104,141,161,6,173,
     152
1008 DATA 6,133,207,173,153,6,133,20
     8
1016 DATA 160,0,140,158,6,173,154,6
1024 DATA 145,207,173,161,6,41,8,240
1032 DATA 92,173,161,6,41,4,208,71
1040 DATA 172,157,6,173,160,6,42,176
1048 DATA 8,136,208,250,141,160,6,24
     0
1056 DATA 54,42,136,208,252,141,148,
     6
1064 DATA 173,136,6,208,2,240,40,173
1072 DATA 148,6,141,160,6,56,173,136
1080 DATA 6,233,1,141,136,6,56,173
1088 DATA 152,6,233,1,141,152,6,173
1096 DATA 153,6,233,0,141,153,6,173
1104 DATA 143,6,240,6,206,143,6,24
1112 DATA 144,99,173,158,6,9,8,141
1120 DATA 158,6,24,144,88,172,157,6
```

```
1128 DATA 173,160,6,106,176,8,136,20
     8
1136 DATA 250,141,160,6,240,71,106,1
     36
1144 DATA 208,252,141,148,6,173,136,
     6
1152 DATA 205,134,6,208,2,240,54,173
1160 DATA 148,6,141,160,6,24,173,136
1168 DATA 6,105,1,141,136,6,24,173
1176 DATA 152,6,105,1,141,152,6,173
1184 DATA 153,6,105,0,141,153,6,173
1192 DATA 143,6,205,142,6,240,6,238
1200 DATA 143,6,24,144,8,173,158,6
1208 DATA 9,4,141,158,6,173,161,6
1216 DATA 41,1,240,83,173,161,6,41
1224 DATA 2,208,62,173,140,6,205,138
1232 DATA 6,208,8,173,141,6,205,139
1240 DATA 6,240,124,24,173,140,6,105
1248 DATA 1,141,140,6,173,141,6,105
1256 DATA 0,141,141,6,24,173,152,6
1264 DATA 109,163,6,141,152,6,173,15
     3
1272 DATA 6,105,0,141,153,6,173,145
1280 DATA 6,205,144,6,240,6,238,145
1288 DATA 6,24,144,75,173,158,6,9
1296 DATA 1,141,158,6,24,144,64,173
1304 DATA 140,6,208,5,173,141,6,240
1312 DATA 54,56,173,140,6,233,1,141
1320 DATA 140,6,173,141,6,233,0,141
1328 DATA 141,6,56,173,152,6,237,163
1336 DATA 6,141,152,6,173,153,6,233
1344 DATA 0,141,153,6,173,145,6,240
1352 DATA 6,206,145,6,24,144,8,173
1360 DATA 158,6,9,2,141,158,6,173
1368 DATA 152,6,133,207,173,153,6,13
     3
1376 DATA 208,173,132,2,240,36,160,0
1384 DATA 177,207,141,154,6,73,255,4
     5
1392 DATA 160,6,141,155,6,173,160,6
1400 DATA 73,255,45,154,6,13,155,6
1408 DATA 141,155,6,173,158,6,240,40
1416 DATA 208,41,160,0,177,207,141,1
     55
1424 DATA 6,173,156,6,45,160,6,141
1432 DATA 161,6,173,160,6,73,255,45
1440 DATA 155,6,141,155,6,13,161,6
1448 DATA 141,154,6,173,158,6,208,3
1456 DATA 24,144,98,41,8,240,17,56
1464 DATA 173,150,6,233,1,141,150,6
1472 DATA 173,151,6,233,0,141,151,6
1480 DATA 173,158,6,41,4,240,17,24
1488 DATA 173,150,6,105,1,141,150,6
1496 DATA 173,151,6,105,0,141,151,6
1504 DATA 173,158,6,41,1,240,18,24
1512 DATA 173,150,6,109,163,6,141,15
     0
1520 DATA 6,173,151,6,105,0,141,151
1528 DATA 6,173,158,6,41,2,240,24
1536 DATA 56,173,150,6,237,163,6,141
1544 DATA 150,6,173,151,6,233,0,141
1552 DATA 151,6,24,144,3,24,144,67
1560 DATA 173,150,6,133,203,173,151,
     6
1568 DATA 133,204,24,173,48,2,105,4
1576 DATA 133,205,173,49,2,133,206,1
     74
1584 DATA 162,6,160,0,165,203,145,20
     5
1592 DATA 200,165,204,145,205,24,165
     ,205
1600 DATA 105,3,133,205,165,206,105,
     0
1608 DATA 133,206,24,165,203,109,163
     ,6
1616 DATA 133,203,165,204,105,0,133,
     204
1624 DATA 202,208,215,173,155,6,160,
     0
1632 DATA 145,207,173,159,6,201,255,
     208
1640 DATA 8,173,132,2,208,3,32,166
1648 DATA 6,96
```

Program 7: Clear Screen Routine

```
900 OPEN #1,8,0,"D1:CLEARS.SUB"
910 FOR I=1 TO 26:READ N:PUT #1,N:NE
    XT I:CLOSE #1:? I:END
1000 DATA 104,104,104,133,208,162,32
     ,169
1008 DATA 0,133,207,160,255,145,207,
     136
1016 DATA 208,251,145,207,230,208,20
     2,208
1024 DATA 238,96
```

Program 8: Fill Subroutine

```
900 OPEN #1,8,0,"D1:FILL.SUB"
910 FOR I=1 TO 230:READ N:PUT #1,N:N
    EXT I:CLOSE #1:? I:END
1000 DATA 173,136,6,141,135,6,173,15
     4
1008 DATA 6,141,146,6,165,207,133,20
     3
1016 DATA 165,208,133,204,162,0,173,
     160
1024 DATA 6,141,148,6,172,157,6,78
1032 DATA 148,6,176,52,136,208,248,1
     73
1040 DATA 146,6,45,148,6,141,149,6
1048 DATA 173,156,6,45,148,6,205,149
1056 DATA 6,240,20,141,149,6,173,148
1064 DATA 6,73,255,45,146,6,13,149
1072 DATA 6,141,146,6,24,144,205,173
1080 DATA 146,6,129,207,141,154,6,96
1088 DATA 173,135,6,205,134,6,240,24
     7
1096 DATA 238,135,6,24,165,203,105,1
1104 DATA 133,203,165,204,105,0,133,
     204
1112 DATA 161,203,141,148,6,173,165,
     6
1120 DATA 141,164,6,173,164,6,45,148
1128 DATA 6,141,149,6,173,164,6,45
1136 DATA 156,6,205,149,6,240,13,172
1144 DATA 157,6,78,164,6,176,193,136
1152 DATA 208,248,240,223,172,157,6,
     14
1160 DATA 164,6,176,29,136,208,248,1
     73
1168 DATA 164,6,45,156,6,141,149,6
1176 DATA 173,164,6,73,255,45,148,6
1184 DATA 13,149,6,141,148,6,24,144
1192 DATA 219,162,0,173,148,6,129,20
     3
1200 DATA 173,146,6,129,207,141,154,
     6
1208 DATA 56,173,135,6,237,136,6,240
1216 DATA 12,168,136,240,8,173,156,6
1224 DATA 145,207,136,208,251,96
```

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Disk Explorer For Commodore

Robert W. Baker

If you've ever been curious about the 1541's memory, this program gives you an inside view of the unit's ROMs. It allows you to display both a disassembly of the 1541's machine language instructions and a hex dump of the drive's RAM and ROM addresses.

"Disk Explorer," a program written for the 64 but suitable for other Commodore users, is designed to let you look around inside the VIC-1541 disk controller. You can directly display a disassembly of the machine language instructions in the disk unit's ROMs. Alternately, you can display a hexadecimal dump of any area of the disk controller 6502 microprocessor's address space, including peripheral chips, RAM, or ROM. With some knowledge about assembly language and a little about hardware, this program provides an easy method of exploring the disk controller.

A Variety Of Choices

When the program starts, there's a short delay while a data array is built for the disassembler (lines 110 – 130). Then you're prompted for the starting address of where you'd like to start looking. The desired address can be entered as a decimal number, or a hexadecimal number preceded by a dollar sign. Program lines 160-240 validate the digits of the address and convert a hex address to a decimal value. An invalid address is discarded and you're prompted again for the starting address.

The program normally displays the data on the screen, but you can select printed output as shown in lines 250 – 270. You'll notice the OPEN statement in line 270 opens either device 3 or 4 depending on whether a printed output is desired. Device 3 is the display screen, and device 4 is the printer. This provides a simple switch between devices for all following PRINT#4 statements without having separate routines for display and printed data. You can still force output to the display screen by using the simple PRINT statement.

The last prompt is for the data display type: either a hexadecimal dump or an instruction disassembly. If a hex dump is selected, then eight bytes of data are displayed, in hex, per screen line. Each line also includes the hex address and the ASCII translation of the data displayed. The ASCII translation is simply the displayable character for each byte shown, with nondisplayable characters converted to periods.

An instruction disassembly shows one 6502 instruction per line using the standard mnemonics. Each line indicates the address of the instruction in both decimal and hex, along with the hex opcode for the instruction displayed. To make things a little easier to read, branch instructions indicate the hex address to which the instruction would branch rather than an offset from the current location.

Three Choices

When displaying data on the screen, the program will pause after 16 lines of hex data or 20 disassembled instructions. A prompt message will ask whether you want to: continue displaying data with the next sequential location; restart the display with a new address and/or format; or stop the program and return to BASIC.

When data is being printed, pressing any key

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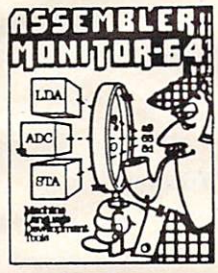

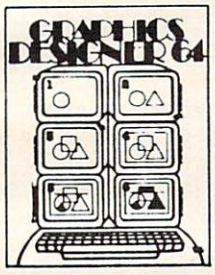

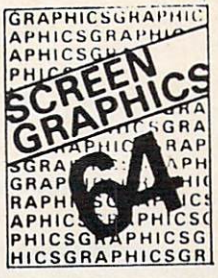

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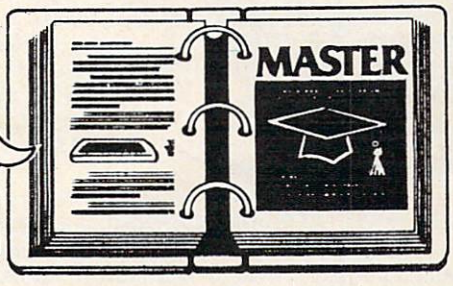

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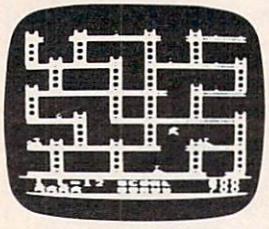

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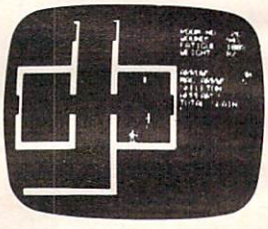

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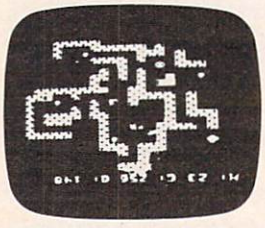

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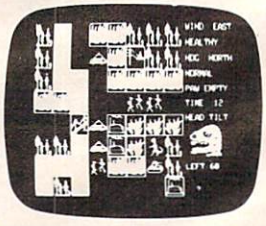

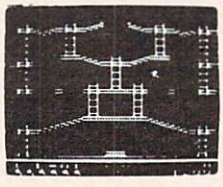

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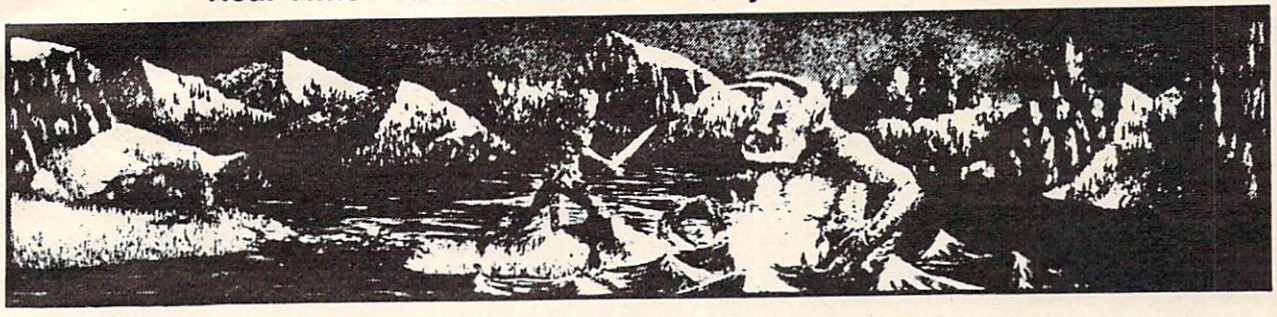

This adventure features full-color animated graphics, sound effects, and two selectable levels of play. It is a real time adventure. The longer you take to find the treasures the more time you allow the thief and cut-throat to get them before you! Journey through forests, a swamp, the haunted mansion, and dungeon in your quest for the fabulous Arkenstone diamond. Battle the giant spider and Baron Ahriman's undead army. You may even find the enchanted elven sword and slay Gothmog himself, But don't let the thief or the cut-throat get their hands on you or the treasures. Fantastic Adventure! We have never had an unsatisfied Adventurer with this one!

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on the keyboard will halt the printer at the end of the next printed line and display the same pause message. You'll also have the same options. I would suggest using the space bar or some key other than the C, R, or S characters to avoid possible problems.

The heart of the program is the M-R command to the disk unit that lets you read any address within the disk controller. All reads of the disk address space are done by the subroutine in lines 605 – 607. Line 605 converts the address (A) to the corresponding high (H) and low (L) bytes for the M-R command. Line 606 first issues the M-R command and then the GET#15 command to read the data from the address specified. The remainder of line 606 and the beginning of line 607 convert the data into the decimal value (V) of the byte.

Exploring The Controller

Now that we know how to use the program, what do we do with it? The first thing you'll probably want to look at is the interrupt vectors at the top of the ROMs. The NMI vector is at $FFFA – $FFFB, the RESTART vector is at $FFFC – $FFFD, and the IRQ vector is at $FFFE – $FFFF. The data in each pair of bytes will be the hex address of the start of the routine that processes the corresponding interrupt. Remember that the addresses will be in the standard 6502 format, low byte first, then high byte.

The RESTART vector is probably the most revealing pointer since this is where the disk controller starts executing instructions when the unit is first turned on. If you follow the instruction flow from there, you'll see the self-test procedures executed when the unit is turned on and the disk controller checks to see that everything is working properly. After these tests, the unit goes on to initialize various pointers and control flags and then waits for a command.

There's 2K of RAM from locations $0000 – $07FF plus 8K of ROM from locations $C000 – $FFFF. Additionally, there are two 6522 Versatile Interface Adapters (VIAs) based at locations $1800 and $1C00. If you do go peeking elsewhere, you may see "reflections" of various devices at other addresses due to the address decoding scheme within the disk controller.

For PET/CBM And VIC Users

Although written for the Commodore 64, this program can also be used on the older PET and CBM models to look into the 4040, 8050, and similar disk units. However, those units have a much more complex structure with two microprocessors and shared memory. You might want to refer to Jim Butterfield's article "Inside the 2040 Disk Drive" on page 94 of the January/February 1980 issue of COMPUTE! for more information.

For VIC-20 users, at least 8K memory expansion is required. You'll have to tinker with reducing the length of the displayed data to fit the 22-column screen. The hex dump can be trimmed to four bytes per line by simply changing the heading in line 1000 and the FOR-NEXT loop count in line 1010. The disassembly display is a little harder to trim, but you could eliminate the decimal address (line 330), separating spaces in the object (lines 350 and 370) and corresponding blanks for no object (SPC in lines 360 and 390), plus fix the heading (line 305).

Disk Explorer

```
90 PRINT"{CLR}{RVS} D I S K{3 SPACES}L O
   {SPACE}O K E R"
100 PRINT"{3 DOWN}INITIALIZING ....
105 OPEN15,8,15
110 DIM M$(255):{2 SPACES}H$="0123456789A
   BCDEF"
120 FOR X=0 TO 255: READ A$: IF A$="*" TH
   EN A$="0*?*"
130 A$=LEFT$(A$+"{6 SPACES}.",6): M$(X)=A
   $: NEXT X
140 PRINT"{CLR}ENTER DECIMAL STARTING ADD
   RESS{DOWN}
150 PRINT"OR HEX ADDRESS PRECEDED BY '$'
   {DOWN}
160 INPUT A$: IF LEFT$(A$,1)="$" THEN 0
170 FOR X=1 TO LEN(A$): C$=MID$(A$,X,1):
   {SPACE}IF C$ < "0" OR C$ > "9" THEN 1
   40
180 NEXT X: A=INT(VAL(A$)/8)*8: GOTO 250
190 A=0: IF LEN(A$)<2 THEN 140
200 FOR X=2 TO LEN(A$): C$=MID$(A$,X,1):
   {SPACE}IF C$ < "0" THEN 140
210 IF C$<="9" THEN A=A*16+VAL(C$): GOTO
   {SPACE}240
220 IF C$<"A" OR C$>"F" THEN 140
230 A=A*16+ASC(C$)-55
240 NEXT X
250 INPUT"{DOWN}WANT PRINTED COPY (Y/N)
   {3 SPACES}N{3 LEFT}";C$
260 P=3:IF LEFT$(C$,1)="Y" THEN P=4
270 OPEN4,P
275 INPUT"{DOWN}HEX DUMP (H) OR DISASSEMB
   LY (D){3 SPACES}H{3 LEFT}";DM$
276 IF DM$<>"D" AND DM$<>"H" THEN 275
280 PRINT"{CLR}";: IF P=3 THEN 300
290 PRINT"DEPRESS ANY KEY TO HALT PRINTER
   ":PRINT#4
300 IF DM$="H" THEN 1000
302 IF DM$<>"D" THEN 300
305 PRINT#4,"{RVS} LOC-DEC/HEX{3 SPACES}O
   BJECT{3 SPACES}DISASSEMBLY{2 SPACES}
   ": PRINT#4
310 IF P=3 THEN FOR N=1 TO 20
320 IF A>65535 THEN A=A-65536
330 A$=STR$(A): L=LEN(A$): PRINT#4,""SPC(
   7-L);A$;" ";
340 Y=A:GOSUB 620: PRINT#4,": ";
350 GOSUB 605: GOSUB 630: PRINT#4," ";:
   {2 SPACES}A=A+1:{2 SPACES}A$=M$(V)
355 IF A>65535 THEN A=A-65536
360 IF LEFT$(A$,1)="0" THEN PRINT#4,""SPC
   (7);MID$(A$,2,3): GOTO 540
370 GOSUB 605: GOSUB 630: PRINT#4," ";: A
   =A+1
```

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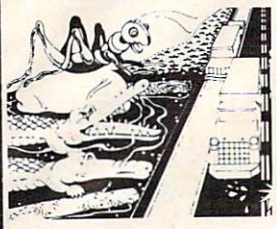

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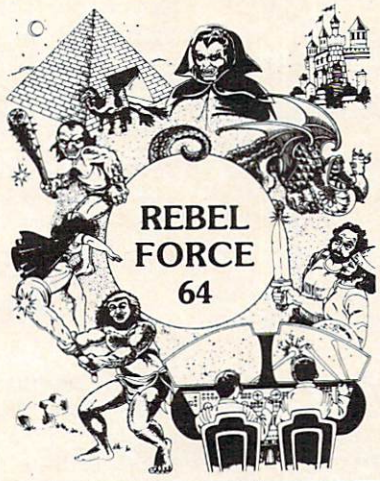

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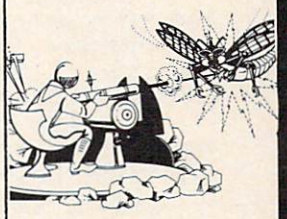

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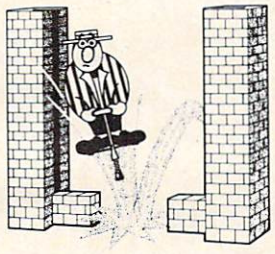

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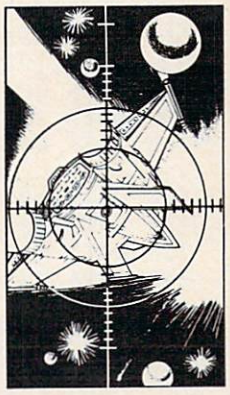

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```
380 IF LEFT$(A$,1)="2" THEN 470
390 PRINT#4,""SPC(4);MID$(A$,2,3);" ";: I
    F MID$(A$,5,1)<>"R" THEN 420
400 IF V>127 THEN V=V-256
410 Y=A+V: IF Y>65535 THEN Y=Y-65536
415 GOSUB 610: GOTO 530
420 IF MID$(A$,5,1)="#" THEN PRINT#4,"#$"
    ;: GOSUB 630: GOTO 530
430 IF MID$(A$,6,1)=")" THEN PRINT#4,"(";
440 PRINT#4,"$";: GOSUB 630: IF MID$(A$,5
    ,1)=" " THEN 530
450 IF MID$(A$,5,2)="Y)" THEN PRINT#4,"),
    Y": GOTO 540
460 PRINT#4,",";MID$(A$,5,2): GOTO 540
470 V1=V: GOSUB 605: GOSUB 630: A=A+1: PR
    INT#4,"{2 SPACES}";MID$(A$,2,3);" ";
475 IF A>65535 THEN A=A-65536
480 Y=V1+(256*V)
490 IF MID$(A$,5,1)=")" THEN PRINT#4,"(";
    : GOSUB 610: PRINT#4,")": GOTO 540
500 GOSUB 610
510 IF MID$(A$,5,1)=" " THEN 530
520 PRINT#4,",";MID$(A$,5,1);
530 PRINT#4
540 IF P=3 THEN NEXT N: GOTO 560
550 GET C$: IF C$="" THEN 320
560 PRINT"{DOWN}{RVS}CONTINUE, RESTART, O
    R STOP (C,R,S) ?{2 SPACES}";
570 GET C$: IF C$="C" THEN 280
580 IF C$="R" THEN CLOSE 4: GOTO 140
590 IF C$<>"S" THEN 570
595 CLOSE15
600 PRINT#4: CLOSE 4: END
605 H=INT(A/256):L=A-(H*256)
606 PRINT#15,"M-R";CHR$(L);CHR$(H):GET#15
    ,AC$:IFAC$=""THENV=0:RETURN
607 V=ASC(AC$):RETURN
610 PRINT#4,"$";
620 V=INT(Y/256): GOSUB 630: V=Y-(V*256)
630 H=INT(V/16): L=V-(H*16)
640 PRINT#4,MID$(H$,H+1,1);MID$(H$,L+1,1)
    ;:{2 SPACES}RETURN
650 DATA 0BRK,1ORAX),*,*,*,1ORA,1ASL,*
660 DATA 0PHP,1ORA#,0ASL,*,*,2ORA,2ASL,*
670 DATA 1BPLR,1ORAY),*,*,*,1ORAY,1ASLX,*
680 DATA 0CLC,2ORAY,*,*,*,2ORAX,2ASLX,*
690 DATA 2JSR,1ANDX),*,*,1BIT,1AND,1ROL,*
700 DATA 0PLP,1AND#,0ROL,*,2BIT,2AND,2ROL
    ,*
710 DATA 1BMIR,1ANDY),*,*,*,1ANDX,1ROLX,*
720 DATA 0SEC,2ANDY,*,*,*,2ANDX,2ROLX,*
730 DATA 0RTI,1EORX),*,*,*,1EOR,1LSR,*
740 DATA 0PHA,1EOR#,0LSR,*,2JMP,2EOR,2LSR
    ,*
750 DATA 1BVCR,1EORY),*,*,*,1EORX,1LSRX,*
760 DATA 0CLI,2EORY,*,*,*,2EORX,2LSRX,*
770 DATA 0RTS,1ADCX),*,*,*,1ADC,1ROR,*
780 DATA 0PLA,1ADC#,0ROR,*,2JMP),2ADC,2RO
    R,*
790 DATA 1BVSR,1ADCY),*,*,*,1ADCX,1RORX,*
800 DATA 0SEI,2ADCY,*,*,*,2ADCX,2RORX,*
810 DATA *,1STAX),*,*,1STY,1STA,1STX,*
820 DATA 0DEY,*,0TXA,*,2STY,2STA,2STX,0
830 DATA 1BCCR,1STAY),*,*,1STYX,1STAX,1ST
    XY,*
840 DATA 0TYA,2STAY,0TXS,*,*,2STAX,*,*
850 DATA 1LDY#,1LDAX),1LDX#,*,1LDY,1LDA,1
    LDX,*
860 DATA 0TAY,1LDA#,0TAX,*,2LDY,2LDA,2LDX
    ,*
870 DATA 1BCSR,1LDAY),*,*,1LDYX,1LDAX,1LD
    XY,*
880 DATA 0CLV,2LDAY,0TSX,*,2LDYX,2LDAX,2L
    DXY,*
890 DATA 1CPY#,1CMPX),*,*,1CPY,1CMP,1DEC,
    *
900 DATA 0INY,1CMP#,0DEX,*,2CPY,2CMP,2DEC
    ,*
910 DATA 1BNER,1CMPY),*,*?,*,1CMPX,1DECX,*
920 DATA 0CLD,2CMPY,*,*,*,2CMPX,2DECX,*
930 DATA 1CPX#,1SBCX),*,*,1CPX,1SBC,1INC,
    *
940 DATA 0INX,1SBC#,0NOP,*,2CPX,2SBC,2INC
    ,*
950 DATA 1BEQR,1SBCY),*,*,*,1SBCX,1INCX,*
960 DATA 0SED,2SBCY,*,*,*,2SBCX,2INCX,*
1000 PRINT#4,"{RVS} LOC{3 SPACES}0
     {2 SPACES}1{2 SPACES}2{2 SPACES}3
     {2 SPACES}4{2 SPACES}5{2 SPACES}6
     {2 SPACES}7{2 SPACES}-ASCII- ":PRINT
     #4:
1010 IF P=3 THEN FOR N=1 TO 16
1040 Y=A:GOSUB 620: PRINT#4,": ";
1045 F$=" ": FOR X=1 TO 8
1047 IF A>65535 THEN A=A-65536
1050 GOSUB 605: GOSUB 630: PRINT#4," ";
1060 V=(V AND 127): IF V<32 OR V>95 THEN
     {SPACE}F$=F$+".": GOTO 1080
1070 F$=F$+AC$
1080 A=A+1: IF A>65536 THEN A=A-65536
1085 NEXT X: PRINT#4,F$
1090 IF P=3 THEN NEXT N:GOTO 560
1100 GETC$:IFC$=""THEN1020
1110 GOTO 560
```

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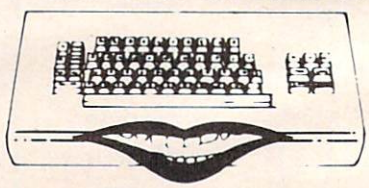

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THE HIDDEN PITFALLS OF COMPUTER ARITHMETIC

Michael A. Covington

Computers sometimes give "false" results after performing calculations. This article discusses the way a computer handles numbers, describes the most common types of errors, and offers solutions.

Here is a simple — and surprising — BASIC program to try on your computer.

```
10 LET A = 0
20 LET A = A + 0.1
30 PRINT A
40 GO TO 20
```

You'd expect it to print the numbers, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, and so on until you stop it. But unless your computer is a TI-99 — which is different in a way we'll get to presently — you probably won't get what you're expecting. If you let the program run long enough, you'll get numbers that are just a bit off, such as 5.00001 or 4.99999 instead of 5. The margin of error may increase as the program runs, or it may rise for a while, then diminish, then go off in the other direction, then diminish to zero again, over and over.

The Computer's Approach To Numbers

What's going on? Well, you've just seen that numbers are not always what they seem inside a computer. We humans ordinarily write numbers in *base 10* notation — that is, there are ten different digits (0 through 9); and in a number like 1234.567, the successive digits represent thousands, hundreds, tens, ones, and, to the right of the point, tenths, hundredths, and thousandths. But numbers inside the computer are represented in *binary* (*base 2*) notation. In the binary system there are only two digits, 0 and 1, and the successive digits represent sixteens, eights, fours, twos, ones, and, to the right of the point, halves, quarters, eighths, sixteenths, and so on. Thus, for example, the decimal number 9.5 goes into binary as 1001.1 (one eight, no fours, no twos, one one, and one half). The place value associated with each digit is half that of the preceding one.

So far, so good. In binary, 2 becomes 10 (one two, no ones), 8 becomes 1000, 39.125 becomes 100111.001, one-sixteenth becomes 0.0001, and so on. But the binary system suffers from a problem that we're already familiar with from the decimal system — there are numbers which can't be represented using a finite number of digits.

Consider 1/3, for example. In decimal notation, 1/3 is approximately 0.3333. A better approximation is 0.3333333333. But a completely correct representation would require an infinitely long list of 3s — you can keep adding decimal places until your paper leaves the galaxy and still never quite get to 1/3. Not surprisingly, 1/3 isn't representable with a finite number of binary digits either.

What is surprising is that many numbers that give us no trouble in decimal notation aren't representable exactly in a finite number of binary digits. In fact, *most* decimal numbers can't be represented exactly in binary. Consider 0.1, for instance. There is no combination of halves, quarters, eighths, sixteenths, and such that exactly adds up to 0.1. If we had an infinite number of binary digits, we could represent 0.1 as 0.0001100110011001100110011001..., with the 0011 repeating ad infinitum. But the computer has only a finite number of binary digits — usually about 24 — and hence it can't represent 0.1 exactly.

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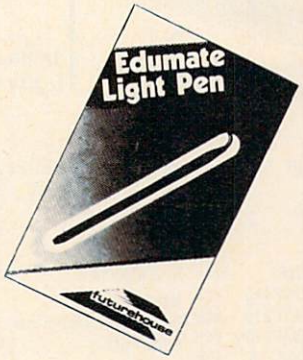

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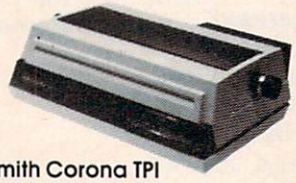

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That's why what gets added to A in the program above isn't exactly 0.1.

A Matter Of Precision

In order to be representable exactly in binary, a number has to be divisible by an integral power of 2, such as 16, 8, 4, 2, 1, 1/2, 1/4, 1/8, and so forth. Since 1 is in the list, all integers (numbers divisible by 1) go into binary without any problem, and you can trust your computer's representation of them. But numbers with decimal places almost always get distorted a bit within the computer.

This is of practical concern because if numbers aren't represented exactly within the computer, your program can't test for precise equality between numbers that were arrived at in different ways. Try this program, for example:

```
10 LET A = 0
20 LET A = A + 0.3
30 PRINT A
40 IF A = 3 THEN 60
50 GO TO 20
60 END
```

Add 0.3 to 0 ten times and you get 3, so the program will terminate after ten cycles through the loop, right? Wrong. What you're adding to A isn't 0.3 exactly, but some binary number very close to 0.3. Add that number to 0 ten times, and you won't get 3 exactly, though you'll be awfully close — probably so close that your computer will round the value to 3 before printing it out. Line 40, however, asks whether A is equal to exactly 3 (unlike 0.3, 3 is an integer and is representable exactly). And A will never hit 3 exactly — so line 40 never has any effect, and the program runs without end. (A few computers have rounding routines that will catch the discrepancy and make line 40 work the way you intended — but don't count on it.)

This leads to an important rule:

> Never test whether two numbers are exactly equal *unless both are integers and result from a process that can't possibly produce anything that isn't an integer. Instead, use "less-than-or-equal-to" or "greater-than-or-equal-to" (to catch numbers going over or under a limit), or test whether the difference between two numbers is sufficiently small.*

For example, in the program above, we could change line 40 to:

```
40 IF A >= 3 THEN 60
```

This will make the program terminate when A reaches or exceeds 3. But that may not be quite what we want — we don't know whether our first attempt to get 3 will be a little low or a little high, and if it's a little low, the statement we've just formulated will not catch it. So we try this:

```
40 IF ABS(A-3) < 0.001 THEN 60
```

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This will catch a number that comes within 0.001 of 3 in either direction.

We noted earlier that TI-99s were different. To be specific, the TI-99/4 is the only computer in widespread use (aside from certain large business computers) that does not convert its numbers into binary. Instead, it represents numbers internally with codes for decimal digits (or rather pairs of them, so that its actual base is 100 rather than 10). Hence, anything you type — with up to 14 significant digits — will be represented exactly. This is, in my opinion, one of the unsung virtues of the TI-99 — there are no errors of representation to worry about.

Calculations With Fields Of Various Lengths

Most home computers allow you the equivalent of about seven decimal digits of accuracy (sometimes rounded off to five or six digits for printing in order to conceal various slight errors). You get seven significant (nonzero) digits regardless of the position of the decimal point, so that, for example, 12345.67, 0.1234567, 12345670000, and 0.000001234567 are equally good. The computer keeps a separate record of where the decimal point goes, and it can be within or outside the string of digits that really count.

Seven digits are usually enough; after all, it's unlikely that you'll be doing calculations based on measurements that are accurate to better than one part in ten million, or dealing with eight-figure salaries, or anything like that. But problems can arise when you're calculating with numbers of widely differing sizes.

Suppose, for instance, you want to compute 0.000853 + 4256.3 − 4256.203. First, the computer adds 4256.3 to 0.000853, giving 4256.300853. But this has too many digits, and the computer truncates it to 4256.300 (that is, 4256.3) — the addition of 0.000853 has had no effect at all. Then 4256.203 is subtracted, giving 0.097. But the correct answer is 0.097853. If you had performed the calculations in a different order, you would have the right answer: 4256.3 − 4256.203 gives 0.097, and this added to 0.000853 gives 0.097853 without any problems. The rule here is:

> Group your calculations *so that, as far as possible, each addition works on numbers of nearly equal size, and operations on numbers of widely differing size are saved until last.*

There really are no sure-fire rules about how to avoid numerical accuracy problems. It's often best to work through some typical cases with a hand calculator, looking at the size of the intermediate results and trying to imagine what could go wrong. ©

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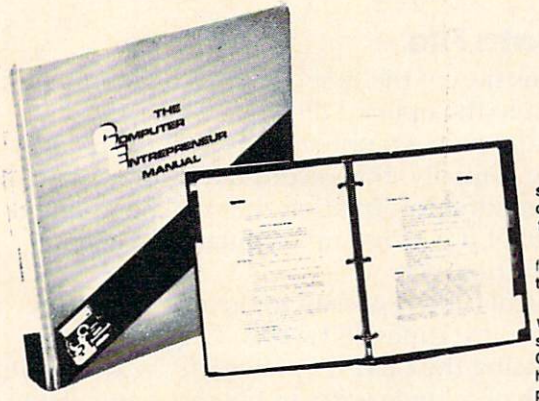

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TI Word Processor

James D Baker

This menu-based word processor includes many of the basic features of commercial word processors: text creation, addition, deletion, modification, paragraphs, pagination, margin control, page overflow, and text centering. Written for the TI-99/4A with Extended BASIC, a disk drive and printer, the program runs with standard 16K memory.

Just like thousands of other TI users, I have added to my system since the original purchase of the computer and a TV set. After I had purchased Extended BASIC, the Peripheral Expansion Box, disk drive and controller, RS-232 interface, and a printer, my next choice was word processing capability. As the Texas Instruments package was not yet on the market and would also require 32K memory expansion, like all others available, I decided to write my own word processor.

This program runs with standard 16K memory because of *linked list* access for text files: Only one line of text is in memory at a time, with before and after indices pointing to the previous or following line of text.

With this design, addition and deletion of text lines are possible. The addition of a single line or an entire paragraph of text is possible and, therefore, updating text after the initial input process is easy.

Automatic pagination, margins (top, bottom, left, and right), page overflow, text centering, and text modification are also included features.

The program is written in two distinct sections: first, the create/edit section, then the print section. If additional features are added, it may be necessary to split the program into two separate programs in order to maintain the objective of minimal memory usage.

Let's look in detail at the program features.

Program Initialization

Upon initial execution of the program, the user will be asked for a filename (assumed on DSK1) where text is stored. The subroutine called in line 140 sets characters in lowercase.

Next, a screen menu is displayed with these options:

N — NEW DATA FILE
A — ADD TO END OF EXISTING FILE
C — CHANGE EXISTING FILE
P — PRINT FILE

New Data File

Upon selection of the first option, a header record is written to the opened disk file. This record is used to maintain a pointer to the last text record in the file. Initially, this record does not contain any meaningful information, but will be updated at the end of the program to contain the actual last record number.

Control is then passed to the routine for entering new text (lines 380 – 470). Original text is entered using the LINPUT statement, which limits the length of a single entry to 128 characters. However, this is not a severe limitation; the program will simply cause wraparound of the text from one record to the next. The computer will beep to remind you that you have exceeded the length of the input string, and you must then press ENTER to cause this record to be written to disk and begin entry of the next record. Also, note that during text entry all the standard control key operations are allowed, including cursor left or right, character delete or insert, erase, etc.

The pointers for previous and next record locations are then updated, and a check for one of the special control functions, /E/, is performed. This is used to indicate the end of text and must be entered as the last record of the text. If the record just entered is not the end marker (/E/), the program writes the text line to disk and returns for the next line of text.

When text entry is complete and the /E/ is entered, lines 490 – 510 update record 0 with the record number of the last record on file. Finally, the option of printing the text is offered. If you answer Y for yes, control is passed to the print routine (line 2400); otherwise the program ends.

COMPUTE!'s Programmer's Reference Guide to the TI-99/4A

Author: C. Regena
Price: $14.95
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Just about the best way to learn how to program a computer is to sit down with a patient friend who already knows how, and ask questions while you experiment with the computer. Owners of the popular Texas Instruments home computer will find that C. Regena is that kind of friend, and *Programmer's Reference Guide to the TI-99/4A* is that kind of book.

Regena carefully explains every BASIC command and function, and all the techniques needed to program TI graphics, sound, and speech. It's hard to think of a question that she doesn't answer simply and clearly, with hints about ways to write programs that do exactly what you want.

The book also provides dozens and dozens of programs, ranging from very short examples to full-length commercial-quality software. In effect, readers can look over Regena's shoulder as she goes through the programming process step by step, explaining what she's doing as she goes along. Not to mention the fact that the finished programs are valuable in their own right.

Even readers who are familiar with the computer will find this book valuable as a reference, where they can look up information they need and find the answers to particular questions.

Above all, *Programmer's Reference Guide to the TI-99/4A* is a book that lets readers use it however they like. You don't have to start at page one and read through, following someone else's plan for what you should learn first and what can wait until later. Instead, you can explore this book from any point of view, to solve almost any programming problem, and find the answer quickly and easily.

C. Regena is **COMPUTE!** Magazine's regular columnist on the TI-99/4A. She's an experienced and resourceful programmer. Like most of her readers, she taught herself how to program, and she hasn't forgotten what it's like to be a beginner, just starting out with the computer. And with *Programmer's Reference Guide*, TI users now have Regena to help them learn how to make their computer do exactly what they want it to do.

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Other special control functions are also included for editing. By entering /C/ as the first three characters of the text line, the print program will automatically center the text that follows on that line. By entering /P/ as the first three characters of a text line, the print program will automatically indent five spaces for a new paragraph. Also, by entering /N/ as the only three characters on a text line, the print program will automatically cause a top-of-page routine to be executed. These special control functions can be entered as upper- or lowercase letters.

Appending

When this second menu option is selected, control is passed to program line 600. This routine simply uses the pointer obtained from the first record on file to retrieve the last record on file (the /E/ record). Then the last actual text record is retrieved by using the previous record pointer from the /E/ record.

The last actual text record on file is then displayed, and control is passed to the routine used for original text entry.

Changing An Existing File

With this option, the program retrieves the first text record, using the pointer obtained from the first record on the file. This line of text and a change menu are then displayed:

```
1=NEXT LINE          5=ADD BEFORE
2=LAST LINE          6=ADD AFTER
3=FWD X LINES        7=CHANGE
4=BKW X LINES        8=DELETE
                     9=QUIT
```

Next Line. This option displays the next text line. If selected, program execution is transferred to line 900. This routine first sets the number-of-records-forward counter to one. The loop in lines 940 – 980 follows the next record pointer through the file until the requested number of records forward has been read.

A check is made to insure that a read past the end of file does not occur. If this is attempted, the program displays the last line of text, a warning message, and returns to the main change menu. Upon completion of the loop, program control is returned to the main change menu.

It should be noted that the loop is not necessary in order to display the next line. However, it is also used to advance any number of records by using the third option discussed below.

Last Line. This option displays the previous line of text. The routine starting at line 1000 provides for stepping backward through the text file. This routine is the same as the prior routine except that the previous record pointer is used in order to proceed to the previous record.

FWD X Lines and BKW X Lines. Both of these options (3 and 4) are handled in the routine beginning at line 1100. The program asks for the number of lines to be read either forward or backward. This value is then placed in the appropriate counter, and control is transferred to the Next Line or Last Line routine.

Add Before and Add After. These options (5 and 6), initially handled by the same routine (at line 1100), allow for adding text, the first before the current line, and the second after. The program displays the current record and, based on which type of add was requested, prompts you to add before or after.

The new line of text is then entered and the record pointers from the current record are saved. The /E/ is retrieved in order to determine the next available location in the file to store a record (next record pointer). This value is saved, and then the /E/ record is rewritten with the next record pointer incremented. Based on the type of add being done, control is transferred to the appropriate routine.

If you selected Add Before (option 5), control is passed to line 1350.

If you selected Add After (option 6), control is passed to line 1450.

Control is then transferred to line 1430 and processing continues as discussed above.

Change. This option allows you to change an existing line of text. The routine for this option begins at line 1540. The text line is broken into 14 lines of "equal" length. Using the DISPLAY AT and ACCEPT AT statements allows the setting of default values for each of the subtext lines to their initial string value. This eliminates the necessity of retyping the entire line to make a minor correction.

The length of each of the subtext lines is calculated and the first 13 lines are displayed. Note that a special character is added to the end of each line. This is done so a space is not lost at the end of the subtext line.

Line 1650 determines if there is any text remaining for the fourteenth line. This is necessary to avoid an error if the string happens to be less than 13 times the rounded length of a single subtext line length. The fourteenth line is then displayed in preparation for change.

The 14 lines are then "looped" through, allowing any changes desired. Note that the maximum length of any subtext line is limited to 26 characters and that if the special end character is accidentally deleted, the program will restore this character. The length of the new text line is recalculated since this length could now exceed the maximum string length permitted by the computer.

After the text has been changed, the new text length is checked to see if it exceeds 225 characters. If the length is less than 226 characters, the text line is reconstructed and control is transferred to

line 2050.

If the length of the new text line exceeds 225 characters, a menu offering two choices is displayed: either update as modified and create a new record on disk or reupdate the line. If the reupdate choice is selected, control is transferred to the beginning of the change routine with no changes made.

If the choice is made to update and create a new record, lines 1900 – 1940 establish two new text strings consisting of the first seven and last seven subtext lines respectively. The current record being changed is then replaced on disk by the first new text string created. The second new text string is then added to the file using the Add After routine. Note that the return switch has been set in line 1950 causing control to return to this routine after the add is completed.

The first of the new records is retrieved, and control is returned to display this as the current record and display the main change menu.

If the change process did not cause a new record to be added, lines 2050 – 2130 display the changed text and offer three choices: perform more updates, update the record as displayed, or exit with no updating.

Delete. The routine for this option, which allows you to delete a line of text, begins at line 2180. You will be asked for confirmation before the delete is executed. If the choice is made not to delete the line, control is passed back to line 780 where the current line is redisplayed and the main menu choices are available.

If you choose to delete the line, the previous and next record pointers from this "to be deleted" record are saved. The previous record is then read and updated with the next record pointer from the deleted record. The record after the deleted record is then read and updated with the previous record pointer from the deleted record. Note that the record just deleted is only deleted from the standpoint that the record pointers no longer allow access to the record.

A check is then made to insure that this delete has not caused all text to be deleted. If this is the case, the program displays a message to that effect and terminates. Otherwise, if a record still exists before the deleted record, control is passed to line 1000 and the previous record is displayed. If the record prior to the deleted record is the header record, control is passed to line 900, and the record following the deleted record is displayed.

Print File

The print routine begins at line 2400. Lines 2480 – 2540 establish the default values for top margin (TM), bottom margin (BM), left margin (LM), page length (PL), lines per page (LPP), and maximum line length (MAXWID). Print control information is then requested, including mode of print (draft or final), spacing (single or double), and optional page numbering.

The input file is then "restored" to restart from the first record on file, and the printer output file is opened. Note that the parallel port is used in this program. If you are using the serial port for your printer, the OPEN statement in line 2730 will require appropriate changes.

The first record on file is read to retrieve the next record pointer for the first text record. The main print "loop" begins at line 2820 where the next text record is read using the next record pointer from the previous record.

If draft printing was requested, control is passed to that routine (line 2880). If the current record is a forced new page request (/N/), the subroutine at line 3900 causes a page eject and the top margin to be printed. Control is then returned to the main print loop.

Line 2850 passes control to the ending routine if this is the last text record. Otherwise, control is passed to the print final routine (line 2980).

Print Draft. This routine (lines 2870 – 2930) simply prints the lines of text in sequence exactly as entered. This includes printing any special print commands, but does not effect these commands. This is useful if you want to see what was entered for verification purposes and do not want pagination, etc. This print mode is also faster than final printing as the special print commands are not executed.

Print Final. This routine begins at line 2980 and prints as much text as will fit on the remainder of the print line, then prints character by character until a space is encountered.

The Print Final routine first checks for any special print commands. If a blank line, centered line, or new paragraph is requested, control is passed to the appropriate routine. If the last character on the text line is a period, two spaces are added to the end of the line to insure proper spacing.

The centering routine begins at line 3550 by printing any unfinished print line and checking for overflow. The length of the text to be centered (excluding the centering command) and the number of spaces required to center the text is then calculated. The line is then printed and control is passed to read the next record.

The routine to print a blank line begins at line 3700. This routine simply prints the preceding line, a blank line, checks for overflow and returns to read the next record.

The routines for top and bottom margins begin at line 3800 and simply loop for the necessary number of blank lines. Page numbering is handled on line 3940.

Lowercase Definition

Finally, the DATA statements in lines 3980 – 4240 represent lowercase letters. These values are assigned according to standard lowercase ASCII characters and are read using the loop in lines 4250 – 4290.

If you'd rather not type in the program, send $3, a SASE, and a blank disk to:

James D. Baker
1562 SW Cynthia St.
Palm Bay, FL 32905

TI Word Processor

```
100 REM WORD PROCESSING
110 REM ENTRY/UPDATE PROGRAM
120 REM EXTENDED BASIC REQUIRED
130 DIM A1$(14)
140 GOSUB 4250
150 CALL CLEAR
160 DISPLAY AT(10,7):"WORD PROCESSI
    NG"
170 DISPLAY AT(11,3):"- ENTRY/UPDAT
    E PROGRAM -"
180 INPUT "FILENAME -DSK1.":F$
190 DISPLAY AT(6,8)ERASE ALL:"SELEC
    T OPTION"
200 DISPLAY AT(9,6):"N - NEW DATA F
    ILE"
210 DISPLAY AT(11,6):"A - ADD TO EN
    D OF"
220 DISPLAY AT(12,10):"EXISTING FIL
    E"
230 DISPLAY AT(14,6):"C - CHANGE EX
    ISTING"
240 DISPLAY AT(15,10):"FILE"
250 DISPLAY AT(17,6):"P - PRINT FIL
    E"
260 DISPLAY AT(20,10):"CHOICE"
270 ACCEPT AT(20,17)BEEP VALIDATE("
    NACP"):C$
280 IF LEN(C$)=0 THEN 260
290 OPEN #1:"DSK1."&F$,RELATIVE,INT
    ERNAL,UPDATE,FIXED 250
300 IF C$="P" THEN 2410
310 IF C$="N" THEN 320 ELSE 340
320 PRINT #1,REC 0:"EOF=";0;1
330 NXTREC=1 :: GOTO 400
340 RECNO=0
350 INPUT #1,REC RECNO:A$,EOFREC,NX
    TREC
360 IF C$="A" THEN 600 ELSE 670
370 REM
380 REM NEW ROUTINE
390 REM
400 CALL CLEAR
410 LINPUT A$
420 LSTREC=CURREC
430 CURREC=NXTREC
440 NXTREC=NXTREC+1
450 IF SEG$(A$,1,3)="/E/" OR SEG$(A
    $,1,3)="/e/" THEN PRINT #1,REC
    CURREC:A$;LSTREC;NXTREC :: EOFR
    EC=CURREC :: GOTO 490
460 PRINT #1,REC CURREC:A$;LSTREC,N
    XTREC
470 GOTO 410
480 REM UPDATE HEADER
490 RECNO=0
500 INPUT #1,REC RECNO:A$,HRECNO,NX
    TREC
510 PRINT #1,REC RECNO:A$,EOFREC,NX
    TREC
520 DISPLAY AT(12,1)ERASE ALL:"DO Y
    OU WANT TO PRINT THE"
530 DISPLAY AT(13,1):"REPORT NOW -
    Y/N"
540 ACCEPT AT(13,18)BEEP SIZE(1)VAL
    IDATE("YNyn"):P$
550 IF P$="Y" OR P$="y" THEN 2410
560 CLOSE #1
570 END
580 REM
590 REM ADD ROUTINE
600 REM
610 INPUT #1,REC EOFREC:A$,CURREC,N
    XTREC
620 INPUT #1,REC CURREC:A$,LSTREC,D
    UMMY
630 CALL CLEAR
640 DISPLAY AT(10,1):"LAST RECORD O
    N FILE IS:"
650 DISPLAY AT(12,1):A$
660 LINPUT A$ :: LSTREC=CURREC :: C
    URREC=EOFREC :: GOTO 450
670 REM
680 REM UPDATE ROUTINE
690 REM
700 CALL CLEAR
710 RECNO=NXTREC
720 INPUT #1,REC RECNO:A$,LSTREC,NX
    TREC
730 DISPLAY AT(2,1):"CURRENT LINE"
740 FOR I=4 TO 13
750 DISPLAY AT(I,1):" "
760 NEXT I
770 DISPLAY AT(4,1):A$
780 DISPLAY AT(14,1):"SELECT CHOICE
    :"
790 DISPLAY AT(16,1):"1=NEXT LINE
    {4 SPACES}5=ADD BEFORE"
800 DISPLAY AT(17,1):"2=LAST LINE
    {4 SPACES}6=ADD AFTER"
810 DISPLAY AT(18,1):"3=FWD X LINES
      7=CHANGE"
820 DISPLAY AT(19,1):"4=BKW X LINES
      8=DELETE"
830 DISPLAY AT(20,16):"9=QUIT"
840 DISPLAY AT(22,1):"YOUR CHOICE:"
850 ACCEPT AT(22,13)BEEP VALIDATE("
    123456789"):C$
860 DISPLAY AT(24,1):" "
870 IF LEN(C$)=0 THEN 840
880 C=VAL(C$)
890 ON C GOTO 900,1000,1100,1100,11
    80,1180,1540,2180,490
900 REM
910 REM DISPLAY NEXT
920 REM
930 NBRFWD=1
940 FOR I=1 TO NBRFWD
950 IF NXTREC=EOFREC THEN DISPLAY A
    T(24,1):"LINE DOES NOT EXIST" :
    : DISPLAY AT(2,1):"LAST LINE OF
      TEXT" :: GOTO 740
960 RECNO=NXTREC
970 INPUT #1,REC RECNO:A$,LSTREC,NX
    TREC
980 NEXT I
```

```
990 GOTO 730
1000 REM
1010 REM DISPLAY LAST
1020 REM
1030 NBRBACK=1
1040 FOR I=1 TO NBRBACK
1050 IF LSTREC=0 THEN DISPLAY AT(24
     ,1):"LINE DOES NOT EXIST" :: D
     ISPLAY AT(2,1):"FIRST LINE OF
     TEXT" :: GOTO 740
1060 RECNO=LSTREC
1070 INPUT #1,REC RECNO:A$,LSTREC,N
     XTREC
1080 NEXT I
1090 GOTO 730
1100 REM
1110 REM FOWARD/BACK X LINES
1120 REM
1130 DISPLAY AT(22,16):"NBR LINES"
1140 ACCEPT AT(22,26)BEEP:NBRLNS
1150 IF C=3 THEN NBRFWD=NBRLNS :: G
     OTO 940
1160 NBRBACK=NBRLNS
1170 GOTO 1040
1180 REM
1190 REM ADD BEFORE/AFTER
1200 REM
1210 CALL CLEAR
1220 IF C=6 THEN PRINT "ADD NEW LIN
     E AFTER:" ELSE PRINT "ADD NEW
     LINE BEFORE:"
1230 PRINT
1240 PRINT A$
1250 PRINT
1260 PRINT "ENTER NEW LINE" :: ::
1270 LINPUT AN$
1280 HREC=RECNO
1290 HLST=LSTREC
1300 HNXT=NXTREC
1310 INPUT #1,REC EOFREC:A$,LSTREC,
     ADDREC
1320 HADD=ADDREC
1330 PRINT #1,REC EOFREC:A$,LSTREC,
     ADDREC+1
1340 IF C=6 OR RETSW=1 THEN 1450
1350 REM
1360 REM ADD BEFORE
1370 REM
1380 PRINT #1,REC HADD:AN$,HLST,HRE
     C
1390 INPUT #1,REC HLST:A$,LSTREC,NX
     TREC
1400 PRINT #1,REC HLST:A$,LSTREC,HA
     DD
1410 INPUT #1,REC HREC:A$,LSTREC,NX
     TREC
1420 PRINT #1,REC HREC:A$,HADD,NXTR
     EC
1430 NXTREC=HADD
1440 IF RETSW=1 THEN 2010 ELSE GOTO
      700
1450 REM
1460 REM ADD AFTER
1470 REM
1480 PRINT #1,REC HADD:AN$,HREC,HNX
     T
1490 INPUT #1,REC HREC:A$,LSTREC,NX
     TREC
1500 PRINT #1,REC HREC:A$,LSTREC,HA
     DD
1510 INPUT #1,REC HNXT:A$,LSTREC,NX
     TREC
1520 PRINT #1,REC HNXT:A$,HADD,NXTR
     EC
1530 GOTO 1430
1540 REM
1550 REM CHANGE
1560 REM
1570 CALL CLEAR
1580 LENA1=INT(LEN(A$)/14)+1
1590 FOR I=1 TO 13
1600 A1$(I)=SEG$(A$,LENA1*(I-1)+1,L
     ENA1)&"~"
1610 DISPLAY AT(I,1):"["
1620 DISPLAY AT(I,2):A1$(I)
1630 DISPLAY AT(I,28):"]"
1640 NEXT I
1650 IF LEN(A$)<=13*LENA1 THEN A1$(
     14)="~" :: GOTO 1670
1660 A1$(14)=SEG$(A$,LENA1*13+1,LEN
     (A$)-LENA1*13)&"~"
1670 DISPLAY AT(14,1):"["
1680 DISPLAY AT(14,2):A1$(14)
1690 DISPLAY AT(14,28):"]"
1700 LENA=0
1710 FOR I=1 TO 14
1720 ACCEPT AT(I,2)BEEP SIZE(-26):A
     1$(I)
1730 IF LEN(A1$(I))=0 THEN A1$(I)="
     ~" ELSE IF SEG$(A1$(I),LEN(A1$
     (I)),1)<>"~" THEN A1$(I)=A1$(I
     )&"~"
1740 LENA=LENA+(LEN(A1$(I))-1)
1750 NEXT I
1760 IF LENA>225 THEN 1820
1770 A$=""
1780 FOR I=1 TO 14
1790 A$=A$&SEG$(A1$(I),1,POS(A1$(I)
     ,"~",1)-1)
1800 NEXT I
1810 GOTO 2050
1820 DISPLAY AT(16,1):"NEW LINE TOO
      LONG"
1830 DISPLAY AT(18,1):"SELECT CHOIC
     E:"
1840 DISPLAY AT(19,1):"1=UPDATE/CRE
     ATE NEW LINE"
1850 DISPLAY AT(20,1):"2=RE-UPDATE"
1860 DISPLAY AT(22,1):"YOUR CHOICE"
1870 ACCEPT AT(22,13)BEEP VALIDATE(
     "12"):C$
1880 IF LEN(C$)=0 THEN 1860
1890 IF C$="2" THEN 1540
1900 A2$="" :: A3$=""
1910 FOR I=1 TO 7
1920 A2$=A2$&SEG$(A1$(I),1,POS(A1$(
     I),"~",1)-1)
1930 A3$=A3$&SEG$(A1$(I+7),1,POS(A1
     $(I+7),"~",1)-1)
1940 NEXT I
1950 RETSW=1
1960 HLDCUR=RECNO
1970 A$=A2$
1980 PRINT #1,REC RECNO:A$,LSTREC,N
     XTREC
1990 AN$=A3$
2000 GOTO 1280
2010 INPUT #1,REC HLDCUR:A$,LSTREC,
     NXTREC
2020 RETSW=0
2030 CALL CLEAR
2040 GOTO 720
```

```
2050 CALL CLEAR
2060 DISPLAY AT(2,1):"CURRENT LINE"
2070 DISPLAY AT(4,1):A$
2080 DISPLAY AT(14,1):"SELECT CHOIC
     E:"
2090 DISPLAY AT(16,1):"1=MORE UPDAT
     ES"
2100 DISPLAY AT(17,1):"2=UPDATE AS
     IS"
2110 DISPLAY AT(18,1):"3=EXIT-NO UP
     DATE"
2120 DISPLAY AT(22,1):"YOUR CHOICE:
     "
2130 ACCEPT AT(22,13)BEEP VALIDATE(
     "123"):C$
2140 IF LEN(C$)=0 THEN 2080
2150 ON VAL(C$)GOTO 1540,2160,720
2160 PRINT #1,REC RECNO:A$,LSTREC,N
     XTREC
2170 GOTO 720
2180 REM
2190 REM DELETE LINE
2200 REM
2210 DISPLAY AT(24,1):"CONFIRM DELE
     TE - Y/N"
2220 ACCEPT AT(24,22)BEEP VALIDATE(
     "YyNn"):D$
2230 IF D$="N" OR D$="n" THEN DISPL
     AY AT(24,1):"LINE NOT DELETED"
      :: GOTO 780
2240 HLST=LSTREC
2250 HNXT=NXTREC
2260 INPUT #1,REC HLST:A$,LSTREC,NX
     TREC
2270 PRINT #1,REC HLST:A$,LSTREC,HN
     XT
2280 INPUT #1,REC HNXT:A$,LSTREC,NX
     TREC
2290 PRINT #1,REC HNXT:A$,HLST,NXTR
     EC
2300 LSTREC=HLST
2310 NXTREC=HNXT
2320 DISPLAY AT(24,1):" "
2330 IF LSTREC>0 THEN GOTO 1000
2340 IF NXTREC=EOFREC THEN 2350 ELS
     E 900
2350 CALL CLEAR
2360 PRINT "TEXT NO LONGER EXISTS"
2370 PRINT
2380 CLOSE #1
2390 END
2400 REM
2410 REM WORD PROCESSING
2420 REM PRINT PROGRAM
2430 REM
2440 CALL CLEAR
2450 REM
2460 REM SET-UP DEFAULTS
2470 REM
2480 TM=6
2490 BM=6
2500 LM=1
2510 PL=66
2520 LC=0
2530 LPP=PL-BM
2540 MAXWID=68
2550 DISPLAY AT(10,7):"WORD PROCESS
     ING"
2560 DISPLAY AT(11,6):"- PRINT PROG
     RAM -"
2570 DISPLAY AT(18,1):"FILENAME - D
     SK1.";F$
2580 DISPLAY AT(20,1):"PRINT MODE -
      D/F"
2590 DISPLAY AT(22,1):"SPACING - S/
     D"
2600 DISPLAY AT(24,1):"PAGE NUMBER
     (Y/N)"
2610 ACCEPT AT(20,20)SIZE(1)BEEP VA
     LIDATE("DFdf"):M$
2620 IF LEN(M$)=0 THEN 2610
2630 IF M$="d" THEN M$="D"
2640 IF M$="f" THEN M$="F"
2650 ACCEPT AT(22,20)SIZE(1)BEEP VA
     LIDATE("SDsd"):SPG$
2660 IF LEN(SPG$)=0 THEN 2650
2670 IF SPG$="s" THEN SPG$="S"
2680 IF SPG$="d" THEN SPG$="D"
2690 ACCEPT AT(24,20)SIZE(1)BEEP VA
     LIDATE("YNyn"):PGNO$
2700 IF LEN(PGNO$)=0 THEN 2690
2710 IF PGNO$="y" THEN PGNO$="Y"
2720 RESTORE #1
2730 OPEN #2:"PIO"
2740 GOSUB 3800
2750 REM
2760 REM READ INITIAL RECORD
2770 REM
2780 INPUT #1:A$,LSTREC,NXTREC
2790 REM
2800 REM READ INPUT FILE
2810 REM
2820 INPUT #1,REC NXTREC:A$,LSTREC,
     NXTREC
2830 IF M$="D" THEN 2850
2840 IF SEG$(A$,1,3)="/N/" OR SEG$(
     A$,1,3)="/n/" THEN PRINT #2 ::
      LC=LC+1 :: GOSUB 3900 :: GOTO
      2800
2850 IF SEG$(A$,1,3)="/E/" OR SEG$(
     A$,1,3)="/e/" THEN 2940
2860 IF M$="F" THEN 2980
2870 REM
2880 REM PRINT DRAFT
2890 REM
2900 PRINT #2:A$
2910 LC=LC+1
2920 IF LC=LPP THEN GOSUB 3900
2930 GOTO 2800
2940 PRINT #2
2950 GOSUB 3910
2960 CLOSE #1 :: CLOSE #2
2970 END
2980 REM
2990 REM PRINT FINAL
3000 REM
3010 IF LEN(A$)=0 THEN 3690
3020 IF SEG$(A$,LEN(A$),1)="." THEN
      A$=A$&"  "
3030 IF SEG$(A$,1,3)="/P/" OR SEG$(
     A$,1,3)="/p/" THEN 3140
3040 IF SEG$(A$,1,3)="/C/" OR SEG$(
     A$,1,3)="/c/" THEN 3540
3050 IF PC+LEN(A$)<=MAXWID THEN 311
     0
3060 NPOS=MAXWID-PC
3070 STRT=1
3080 INIT=NPOS+1
3090 IF INIT<1 THEN INIT=1
3100 GOTO 3300
3110 PRINT #2:A$;
3120 PC=PC+LEN(A$)
```

```
3130 GOTO 2800
3140 REM
3150 REM **NEW PARAGRAPH**
3160 REM
3170 IF PC>LM THEN PRINT #2 :: LC=L
     C+1 :: PRINT #2:RPT$(" ",LM);
3180 IF SPG$="D" AND PC>LM THEN PRI
     NT #2 :: LC=LC+1 :: PRINT #2:R
     PT$(" ",LM);
3190 PC=LM
3200 IF LC>=LPP THEN GOSUB 3900
3210 PRINT #2:"{5 SPACES}";
3220 IF LEN(A$)+LM+2>MAXWID THEN 32
     60
3230 PRINT #2:SEG$(A$,4,LEN(A$)-3);
3240 PC=LEN(A$)+2+LM
3250 GOTO 2800
3260 NPOS=MAXWID-5-LM
3270 STRT=4
3280 INIT=NPOS+4
3290 REM
3300 REM **PRINT PARTIAL LINE**
3310 REM
3320 IF PC>MAXWID THEN 3380
3330 PRINT #2:SEG$(A$,STRT,NPOS);
3340 PC=MAXWID
3350 REM
3360 REM **PARSE & PRINT**
3370 REM
3380 FOR I=INIT TO LEN(A$)
3390 PC=PC+1
3400 A2$=SEG$(A$,I,1)
3410 IF PC=1+LM AND A2$=" " THEN PC
     =LM :: GOTO 3440
3420 IF A2$=" " THEN 3460
3430 PRINT #2:A2$;
3440 NEXT I
3450 GOTO 2800
3460 INIT=I :: PRINT #2 :: LC=LC+1
     :: PRINT #2:RPT$(" ",LM);
3470 IF SPG$="D" THEN PRINT #2 :: L
     C=LC+1 :: PRINT #2:RPT$(" ",LM
     );
3480 IF LC>=LPP THEN GOSUB 3900
3490 PC=LM
3500 IF INIT=LEN(A$)THEN 2800
3510 IF SEG$(A$,INIT,1)=" " THEN IN
     IT=INIT+1 :: GOTO 3500
3520 A$=SEG$(A$,INIT,LEN(A$)-INIT+1
     )
3530 GOTO 3050
3540 REM
3550 REM CENTERING ROUTINE
3560 REM
3570 IF PC>LM THEN PRINT #2 :: LC=L
     C+1 :: PRINT #2:RPT$(" ",LM);
3580 IF PC>LM AND SPG$="D" THEN PRI
     NT #2 :: LC=LC+1 :: PRINT #2:R
     PT$(" ",LM);
3590 PC=LM
3600 IF LC>=LPP THEN GOSUB 3900
3610 CLEN=LEN(A$)-3
3620 SP=INT((MAXWID-LM-CLEN)/2)
3630 PRINT #2:RPT$(" ",SP+LM);
3640 PRINT #2:SEG$(A$,4,LEN(A$))
3650 LC=LC+1 :: PRINT #2:RPT$(" ",L
     M);
3660 IF SPG$="D" THEN PRINT #2 :: L
     C=LC+1 :: PRINT #2:RPT$(" ",LM
     );
3670 IF LC>=LPP THEN GOSUB 3900
3680 GOTO 2800
3690 REM
3700 REM PRINT BLANK LINE
3710 REM
3720 IF PC=LM THEN 3750
3730 PRINT #2 :: LC=LC+1
3740 IF SPG$="D" THEN PRINT #2 :: L
     C=LC+1
3750 PRINT #2 :: LC=LC+1 :: PRINT #
     2:RPT$(" ",LM);
3760 IF SPG$="D" THEN PRINT #2 :: L
     C=LC+1 :: PRINT #2:RPT$(" ",LM
     );
3770 IF LC>=LPP THEN GOSUB 3900
3780 PC=LM
3790 GOTO 2800
3800 REM
3810 REM PRINT TOP MARGIN
3820 REM
3830 FOR LC=1 TO TM
3840 PRINT #2
3850 NEXT LC
3860 LC=TM
3870 PRINT #2:RPT$(" ",LM);
3880 PC=LM
3890 RETURN
3900 REM
3910 REM PRINT BOTTOM & TOP MARGINS
3920 REM
3930 FOR LCT=LC+1 TO PL
3940 IF PGNO$="Y" AND LCT=PL-3 THEN
      PGNO=PGNO+1 :: PRINT #2:RPT$(
     " ",38);"PAGE ";PGNO ELSE PRIN
     T #2
3950 NEXT LCT
3960 GOSUB 3800
3970 RETURN
3980 REM RE-DEFINE LOWER CASE CHARA
     CTERS
3990 DATA 0000003804 3C443C
4000 DATA 0004040784 4444478
4010 DATA 0000003C40 404403C
4020 DATA 0004043C44 44443C
4030 DATA 0000003844 78403C
4040 DATA 0018242020 702020
4050 DATA 0000304838 082810
4060 DATA 0040404078 444444
4070 DATA 0010001010 101010
4080 DATA 0004000404 042418
4090 DATA 0040485060 504848
4100 DATA 0010101010 101010
4110 DATA 0000002854 444444
4120 DATA 0000007844 444444
4130 DATA 0000003844 444438
4140 DATA 0000704870 404040
4150 DATA 00001C241C 040404
4160 DATA 0000005864 404040
4170 DATA 0000003C40 380478
4180 DATA 0000207020 202418
4190 DATA 0000004444 444438
4200 DATA 0000004444 442810
4210 DATA 0000004444 546C44
4220 DATA 0000004428 102844
4230 DATA 0000442418 102040
4240 DATA 0000007C08 10207C
4250 FOR I=97 TO 122
4260 READ A$
4270 CALL CHAR(I,A$)
4280 NEXT I
4290 RETURN
```

©

Son Of Lister For VIC And 64

Jim Butterfield, Associate Editor

This updated version of a previously published COMPUTE! program, "Lister," includes modifications for the VIC and 64. "Son Of Lister" translates tokens from other Commodore machines and produces a readable listing to facilitate program conversions.

"Lister," a program published in COMPUTE! (December 1982, p. 192), lists a BASIC program directly from disk — slowly. The only justification for its slowness is that the listing is neat and very readable.

One of the reasons for Lister was that many users couldn't read programs written for other models of Commodore machines because their machine didn't have the same vocabulary. For example, if a 4.0 program contained the command DCLOSE, other systems — not 4.0 — couldn't list the program without getting nonsense.

So Lister allowed us to get a neat listing — and to get a cross-listing of other machines' programs.

Out Go The Windows, In Come The Colors

That was all very well. At the time I wrote it, Lister could be all things to all people. Now there are a few new wrinkles.

First, the new colors used by the Commodore 64 call for new "cursor words" — but there's a twist. Some of the characters used for color in the 64 were used in the 80-column machines for entirely different purposes. We can no longer be universal — we must decide which computer's program we are translating.

It seems sensible to guess that a Commodore 64 is more likely to want to list a 64 program than a CBM 8032 program. In fact, VIC and 64 have much in common and it's likely that they will want to look at each other's programs fairly often. So, out goes the special 8032 window, scroll, and line clear commands. Make way for the new colors.

You can change this to suit your purposes, of course. If an 8032 listing is what you want, go for it — dig back to the December issue and replace the new colors with the 80-column commands.

Screen Width

On the PET/CBM, we had to deal with 80-column and 40-column screens, plus an 80-column printer. On the VIC/64, we must work with 22 or 40 columns, or (again) an 80-column printer. We must search for the screen width in a different way. No big deal — just a different type of programming.

Making a pretty listing on a VIC, with only 22 columns, is a tough task, of course. But the computer will try its best.

And A Challenge

What about extra keywords? The 4.0 machines have extra commands — like DLOAD, for example — which have no counterpart in the VIC/64. Or do they? Some of the "expanders" which add 4.0 commands are said to use the same tokens — in which case, usage will be the same as for 4.0. The program as given still recognizes the 4.0 set.

But that's only one approach. If you're a graphics nut, and have fitted a Super Expander to your VIC, you will be using new commands of your own, such as GRAPHIC or CIRCLE. In this case, you don't want the 4.0 commands — you

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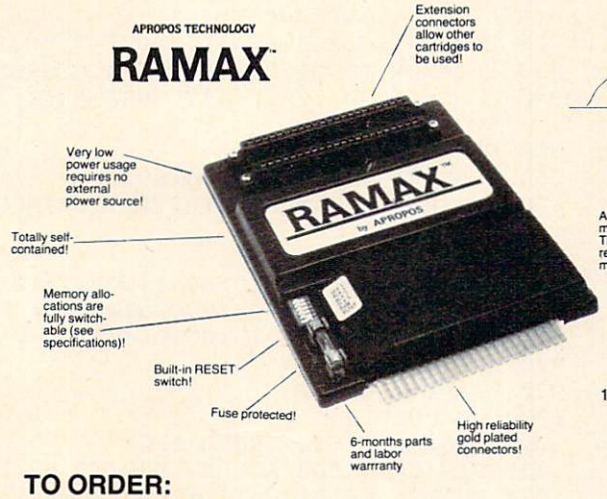

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want the special keywords your program uses. If so, try digging into the DATA statements in "Son Of Lister." Common sense will reveal the changes needed. Experiment — write programs, see how they list, and see what you need to change.

A Token Of Happiness

A word of explanation for beginners. Every time you use a keyword — PRINT, for example — the computer crunches it up into a single byte called a *token*. Only when you say LIST will the token be unfolded into its original form. That's why you can type in a line like 10 ? and have it list as 10 PRINT. Neither the question mark nor the PRINT word was stored as such — just a one-byte token which represents the command.

One of the ways that Son Of Lister works is to draw the program directly from the disk, and translate the tokens using its own BASIC program. In doing so, it can print out commands that might not even be available on the VIC or 64.

This way, you can read a program from some other Commodore machine — and try to figure out how to modify it for your own computer. And in the meantime, you get a neat listing — in both senses of the word.

Son Of Lister

```
90 REM LISTER..VIC/64
100 DATA 19,147,17,145,29,157,18,146,20,1
    48,141,32
110 REM 80-COLUMN CURSOR STUFF
120 DATA 129,149,150,151,152,14,142,153,1
    54
130 DATA 155
140 REM VIC STUFF
150 DATA 144,5,28,159,156,30,31,158
160 DATA 8,9,133,137,134,138,135,139,136,
    140
170 DATA HOME,CLEAR,DOWN,UP,RIGHT,LEFT,RV
    S,RVOFF,DEL,INST,RETURN,SPACE
180 DATA ORANGE,BROWN,L.RED,GRAY1,GRAY2,T
    EXT,GRAPHIC,L.GREEN,L.BLUE
190 DATA GRAY3
200 DATA BLACK,WHITE,RED,CYAN,MAGENTA,GRE
    EN,BLUE,YELLOW
210 DATA LOCK,UNLOCK,F1,F2,F3,F4,F5,F6,F7
    ,F8
220 DIMA(40),A$(40),K$(90)
230 FORJ=0TO39:READA(J):NEXTJ
240 FORJ=0TO39:READA$(J):NEXTJ
250 DATA END,FOR,NEXT,DATA,INPUT#,INPUT,D
    IM,READ,LET,GOTO,RUN,IF,RESTORE,GOSUB
260 DATA RETURN,REM,STOP,ON,WAIT,LOAD,SAV
    E,VERIFY,DEF,POKE,PRINT#,PRINT,CONT
270 DATA LIST,CLR,CMD,SYS,OPEN,CLOSE,GET,
    NEW,TAB(,TO,FN,SPC(,THEN,NOT,STEP
280 DATA +,-,*,/,↑,AND,OR,>,=,<,SGN,INT,A
    BS,USR,FRE,POS,SQR,RND,LOG,EXP,COS
290 DATA SIN,TAN,ATN,PEEK,LEN,STR$,VAL,AS
    C,CHR$,LEFT$,RIGHT$,MID$,GO,CONCAT
300 DATA DOPEN,DCLOSE,RECORD,HEADER,COLLE
    CT,BACKUP,COPY,APPEND,DSAVE,DLOAD
310 DATA CATALOG,RENAME,SCRATCH,DIRECTORY
320 FORJ=0TO90:READK$(J):NEXTJ
400 CLOSE1:INPUT"NAME OF PROGRAM FILE";G$
410 OPEN 1,8,3,G$+",P,R"
420 GET#1,A$,B$
430 IFA$<>CHR$(1)ANDA$<>""GOTO400
440 IFA$=""THENA$=CHR$(1):GET#1,X$
450 INPUT"LINE NUMBER RANGE{2 SPACES}-
    {3 LEFT}";Z$
460 L0=0:L1=0:L2=1E9
470 FORJ=1TOLEN(Z$):Y$=MID$(Z$,J,1)
480{2 SPACES}Y=ASC(Y$):IFY>=48ANDY<=57GOT
    O510
490{2 SPACES}IFY=32GOTO510
500{2 SPACES}L0=J:IFY<>45GOTO600
510 NEXTJ
520 IFL0<LEN(Z$)THENL2=VAL(MID$(Z$,L0+1))
    :IFL2=0THENL2=1E9
530 IFL0>1THENL1=VAL(Z$)
540 IFL0=0THENL1=L2
600 P3$="[":P4$="]":INPUT"LIST TO PRINTER
    {2 SPACES}N{3 LEFT}";Z$
610 P=3:IFASC(Z$)=89THENP=4:L$="{DOWN}":P
    3$=CHR$(219):P4$=CHR$(221)
620 P1$="[":P2$="]":INPUT"GRAPHICS OR TEX
    T{2 SPACES}G{3 LEFT}";Z$
630 PRINTCHR$(142);:IFASC(Z$)=84THENPRINT
    CHR$(14);:M$=L$:P1$=P3$:P2$=P4$
640 INPUT"TRANSLATE CURSOR MOVES
    {2 SPACES}N{3 LEFT}";Z$
650 IFASC(Z$)=89THENT7=1
660 OPEN4,P:F$=P1$
670 J=80:IFP<>3GOTO690
680 PRINT"{CLR}":J=PEEK(213)+1
690 L9=J:PRINT#4,"PROGRAM:{2 SPACES}";G$
700 REM NEW LINE
710 GOSUB2010:Q=0:T1=1:C1=-1:GET#1,A$,B$:
    IFST<>0GOTO3000
720 IFB$=""GOTO3000
730 GET#1,A$,B$
740 L=ASC(A$+CHR$(0))+ASC(B$+CHR$(0))*256
750 IFL<L1GOTO1080
760 IFL>L2GOTO3000
770 F2=1:PRINT#4,M$;P$:P$=STR$(L)+" "
800 REM START TEXT HERE
810 GET#1,A$:IFA$=""GOTO710
820 T=0:A=ASC(A$):IFA=32ANDF$=","GOTO840
830 IFQ=0OR(AAND127)>31ORT7=0GOTO900
840 FORJ=0TO40:IFA=A(J)THENB$=A$(J):GOTO8
    60
850 NEXTJ:GOTO1000
860 IFB$=B1$THENB=B+1:GOTO810
870 IFB>0THENA$=MID$(STR$(B+1),2)+F$+B$:G
    OTO890
880 A$=F$+B$
890 B=0:B1$=B$:F$=",":F1=1:GOTO1010
900 A=A-128:IFA<0ORQ<>0GOTO1000
910 IFA=127THENA$="↑":GOTO1000
920 T=1:A$=K$(A)
930 IFA=15THENQ=2
1000 GOSUB2010
1010 IFA$=CHR$(34)THENQ=1-Q
1020 REM C=-1 FOR ALPHANUMERIC
1030 C=ASC(LEFT$(A$,1)):C=(C<48ORC>57)AND
     (C<65ORC>90)
1040 IFT<>T1ORT=1THENT1=T:IFNOTCANDNOTC1T
     HENP$=P$+" ":GOSUB2500
1050 C=ASC(RIGHT$(A$,1)):C1=((C<48ORC>57)
     AND(C<65ORC>90))ORA=37
1060 P$=P$+A$:GOSUB2500
1070 GOTO810
1080 REM SKIP TO NEXT LINE
1090 GET#1,A$:IFA$=""GOTO710
```

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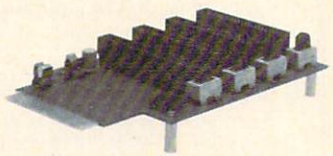

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```
1100 GOTO1090
2000 REM CLOSE OFF CURSOR EXPRESSION
2010 IFF1=0GOTO2040
2020 IFB>0THENP$=P$+MID$(STR$(B+1),2):GOS
     UB2500
2030 B=0:F1=0:B1$="":P$=P$+P2$:GOSUB2500:
     F$=P1$
2040 RETURN
2500 IFLEN(P$)<L9GOTO2600
2510 FORJ=L9TOL9*.6STEP-1
2520 IFMID$(P$,J,1)=":"GOTO2580
2530 NEXTJ:FORJ=L9-1TOL9*.6-1STEP-1
2540 P=ASC(MID$(P$,J))
2550 IFP=91GOTO2580
2560 IFP=59ORP=44ORP=93THENJ=J+1:GOTO2580
2570 NEXTJ:J=L9-1
2580 PRINT#4,M$;LEFT$(P$,J-1)
2590 P$="{4 SPACES}"+MID$(P$,J)
2600 RETURN
3000 IFLEN(P$)>0THENF2=1:PRINT#4,M$;P$
3010 IFF2=0THENPRINT"** NO LINES FOUND **
     "
3020 CLOSE1:GOSUB2000:CLOSE4
```

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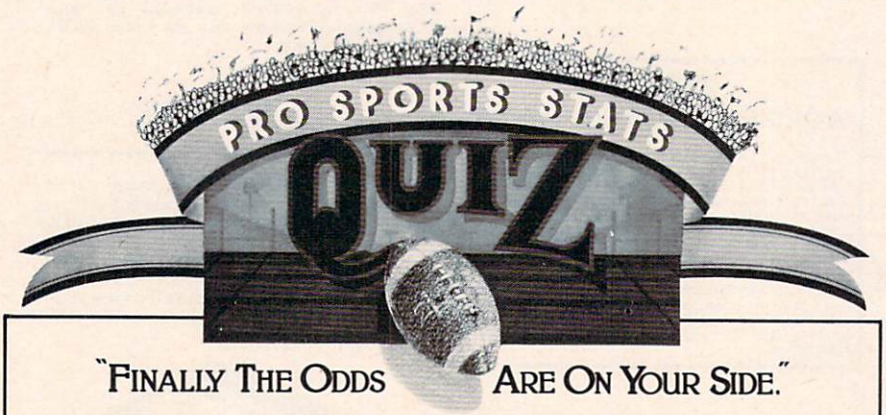

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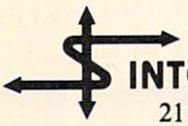

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Commas And Colons In Applesoft Strings: An Easy Way To Use Them

Donald W. Watson

Commas and colons are not allowed with Applesoft strings — and this can be troublesome at times. Here's a solution. Also included is a program for Apple II disk users.

The Keyboard Problem

INPUT X$ is the convenient instruction for entering strings with an Applesoft II BASIC program; however, the string to be entered under the variable name X$ may not contain commas or colons. If either is present, the string will be truncated at the first occurrence when the RETURN key is pressed. The comma or colon and all characters following will be lost, and Applesoft will send the ?EXTRA IGNORED message to the printer or to the screen.

In programs written for business use, it is often essential to include commas and colons in strings entered by the user. Programmers may not mind, but consider the user's frustration on learning that he or she cannot use commas or colons in places where they are normally required for acceptable format. For example, JONES, JAMES. J. is a common format for names in a list; RECEIPTS: might be a desirable heading for a list or group on a business report or ledger. In the latter example, the colon can be avoided by underlining the heading, but only at the expense of the user's choice, printer time, and perhaps report line space. Restricting alternatives is not in the user's interest. Here is a practical solution to the problem.

A Keyboard Solution

The *Applesoft BASIC Programming Reference Manual* is not much help on this subject although a clue to a solution is offered in Chapter 6 where the INPUT and GET instructions are defined and discussed. On page 68, a suggestion is made that "serious programmers GET numbers" by using a GET X$ instruction, where the keyboard response will be a string assigned to the string variable X$ when the RETURN key is pressed.

"String Entry" allows the entry of strings which can contain *all* characters from the Apple II keyboard. But String Entry does much more. The program contains routines which duplicate the most important Apple II string-editing capabilities (right- and left-arrow functions). It also provides some useful entry control functions for convenience in writing, displaying, and deleting strings.

A Free Keyboard

Type the listing into memory and proofread it carefully. When you're sure it is correct, SAVE it to a disk with a short name like STRENT. Then type RUN (with the program still in memory). The instruction line will appear. Experiment with the string entry process, noting that you now have the full freedom of the keyboard. You can enter strings with any characters you like, and you have normal editing functions with entry and deletion control. Best of all, the ?EXTRA IGNORED message never appears, and nothing is ignored unless you choose to have it ignored.

Most of String Entry (it's about 600 bytes long) can be used, with slight modification, in a larger program. If used to control string entry for more than one or two fields, it must be generalized for use as a subroutine, mostly by using integer variables V% and H% in the calling routine. VTAB V% and HTAB H% instructions can then be used in the subroutine to allow complete freedom when choosing a location for the string display on the screen.

The Apple II Disk Problem

The keyboard problem with commas and colons to be used in strings has been solved by avoiding

the INPUT X$ instruction and using a GET X$ routine instead. But Apple II disk operations require the use of the INPUT X$ instruction to retrieve string data from a disk text file. If the string to be retrieved contains commas or colons, the ?EXTRA IGNORED message will occur; the string will be truncated as if it were entered from the keyboard in response to INPUT X$.

To correct this, try these two simple changes and some short additions to the String Entry program.

1. Delete: GOTO 1020 from the end of line 1190.

2. Add the lines below to the String Entry program.

3. SAVE the modified and expanded program String Entry under its abbreviated name, STRENT.

```
1300  REM WRITE S$ CONTENT TO DISK
1310  PRINT D$;"OPEN STRFILE"
1320  PRINT D$;"DELETE STRFILE"
1330  PRINT D$;"OPEN STRFILE"
1340  PRINT D$;"WRITE STRFILE"
1350  PRINT S$
1360  PRINT D$;"CLOSE STRFILE"
1400  REM RETRIEVE S$ CONTENT FROM DISK
1410 S$ = ""
1420  PRINT D$;"OPEN STRFILE"
1430  PRINT D$;"READ STRFILE"
1440  INPUT S$
1450  PRINT D$;"CLOSE STRFILE"
1500  REM DISPLAY RETRIEVED S$ CONTENT
1510  VTAB 20: HTAB 8: PRINT  TAB( 39);
    : HTAB 9: PRINT S$: GOTO 1020
```

Save this expanded version to disk under the original filename STRENT.

Type RUN to execute the expanded program still in memory. The operator instruction line will appear. Using no commas and no colons, experiment with a few string entries. Each string entered will be stored on disk, and the program will echo the string by displaying it (as retrieved from the disk text file) a second time.

Now, perform a test. Enter a string containing a comma or colon, or both. Try NAME: JONES, JAMES J., for instance. When you have entered the string, it remains displayed at the string entry format line. It goes to the STRFILE at the disk under the permanent variable name S$. S$ in computer memory is nulled, S$ is retrieved from STRFILE, and the retrieved content of S$ is displayed on the screen.

But disaster strikes again. First, the dreaded ?EXTRA IGNORED message is displayed, and then the string is displayed in incomplete form. Read on for help.

An Apple II Disk Solution

The Apple II disk system (DOS 3.2 or DOS 3.3) will accept the contents of S$ as a literal string if the contents begin with a quote (") mark. The disk retrieval problem can be avoided by changing S$ temporarily with the statement S$ = CHR$(34) + S$.

To try this technique, just change line 1350 to the following:

```
1350 PRINT CHR$(34) + S$
```

SAVE the program once more under the filename STRENT and RUN it. Now, you will find that the test string NAME: JONES, JAMES J. can be correctly entered and correctly retrieved. And so can any string containing any characters from the Apple II keyboard, including commas and colons.

String Entry

```
1000  REM STRING ENTRY
1010  HOME : DIM C$(30):D$ =  CHR$ (4)
1020  VTAB 15: HTAB 9: PRINT "TYPE ";
1025  INVERSE : PRINT "E";: NORMAL : PRINT
    " TO ENTER NEW STRING ";
1030  GET E$: VTAB 15: HTAB 9: PRINT  TAB(
    39)
1040  VTAB 10: HTAB 8: PRINT "?";: FOR
    X = 1 TO 25:C$(X) = "": PRINT ".";
    : NEXT X: HTAB 9:X = 1
1050  IF X > 25 THEN  PRINT  CHR$ (7): GOTO
    1160
1060  GET C$: IF X > 1 THEN 1090
1070  IF  ASC (C$) = 13 THEN 1190
1080  IF  ASC (C$) < 33 OR  ASC (C$) >
    90 THEN S$ = "": GOTO 1040
1090  IF C$(1) = "0" AND X = 2 AND  ASC
    (C$) = 13 THEN S$ = "": GOTO 1190
1100  IF  ASC (C$) = 13 THEN 1160
1110  IF  ASC (C$) > 31 AND  ASC (C$) <
    91 THEN  PRINT C$;:C$(X) = C$:X =
    X + 1: GOTO 1050
1120  IF  ASC (C$) = 8 THEN X = X - 1: HTAB
    (8 + X): GOTO 1060
1130  IF  ASC (C$) = 21 AND C$(X) <  >
    "" THEN X = X + 1: HTAB (8 + X): GOTO
    1050
1140  IF  ASC (C$) = 21 THEN  HTAB (8 +
    X): GOTO 1060
1150  HTAB (8 + X): GOTO 1040
1160 ST$ = "": FOR L = 1 TO X - 1:ST$ =
    ST$ + C$(L): NEXT L
1170 R$ =  RIGHT$ (ST$,1): IF  ASC (R$)
     = 32 THEN ST$ =  LEFT$ (ST$, LEN
    (ST$) - 1): GOTO 1170
1180 S$ = ST$
1190  VTAB 10: HTAB 8: PRINT  TAB( 39);
    : HTAB 9: PRINT S$: GOTO 1020
```

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ATARI CHARTMAKER

Tom R. Halfhill, Features Editor

Here's a relatively short but versatile program you can use to draw charts on the screen with your Atari — charts you customize to fit your own needs.

Why do you need charts? (That's what they used to say about computers, too.) Well, almost everybody has something to chart. I once used this program, for example, to chart weekly interest rates of the two money market mutual funds in which my spare cash was invested. But I purposely designed the program for easy modification so you can chart whatever you want: stock quotes and dividends, pork belly futures, bowling scores, jogging information, sunspot activity — even pounds lost on your diet.

Besides allowing you to draw charts to any scale to fit your own data, the program also includes a subroutine to display your own labels in GRAPHICS 0 text within the GRAPHICS 8 graphics window. And by experimenting with the program in ways described below, you can also learn something about statistical rhetoric — how clever statisticians can manipulate the scales of charts to influence the way you think.

Charts In Hi-Res

The program requires at least 16K, mainly because it uses GRAPHICS 8, which steals 7,900 bytes of RAM off the top before you even start. Another disadvantage of GRAPHICS 8 is that only one color besides the background default is available (disregarding special display list interrupts and other complexities we won't discuss here). It would be nice if different colored lines could be charted to keep track of different arrays of data. However, I used GRAPHICS 8 because it is the highest resolution mode and allows the greatest accuracy when charting lines.

The program draws the chart one point at a time by fetching numbers which you place in DATA statements at the bottom of the program. If you want, you can substitute INPUT loops and numeric arrays for the DATA statements, but I've found it just as fast to add my weekly updates to the DATA rather than to fool around with separate data files and so forth. If your needs differ, replace the subroutine at lines 1500 – 1620 with your INPUT loops.

The scales are easily customized by changing the values of a few variables in lines 50 and 60. Changing only a few numbers in these lines allows you to define the number of points in the scales drawn along all four sides of the chart. In the example program, the vertical borders are divided into 20 points to plot stock prices from $0 to $20 per share. The horizontal borders are divided to represent the 52 weeks in a year. You also define additional markers; in this example, the share prices are subdivided into $5 sections, and the 52 weeks are subdivided into four quarters.

Customizing The Program

Modifying these scales is simple. Let's say you're charting the growth of an Individual Retirement Account from $0 to $10,000 in $250 increments. You need to divide the vertical (Y axis) borders into 40 units (10,000/250). Just change the variable YSCALE in line 50 from 20 to 40. To further subdivide this scale with markers for every $1,000, just change the variable YMARKERS in line 60 from 4 to 10 (10,000/1,000).

Now let's say you want to chart this growth monthly for two years, rather than weekly for one year, as in the example below. You need to divide the horizontal (X axis) borders into 24 units (2 years with 12 months each). Simply change the variable XSCALE in line 50 from 52 to 24. To subdivide this scale with additional markers for each quarter, change the variable XMARKERS in line 60 from 4 to 8 (4 quarters per year * 2 years).

The only other thing you have to do is substi-

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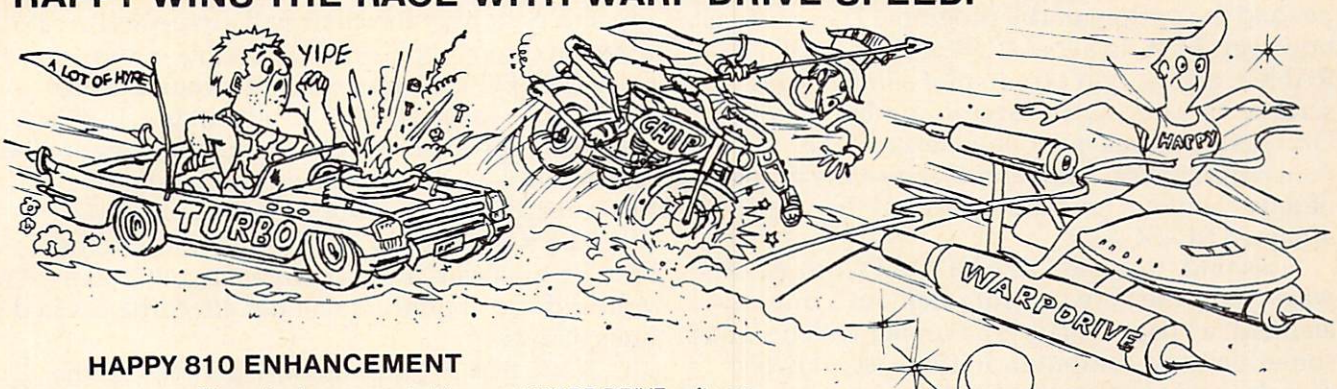

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tute your own data for mine starting at line 2300. You can add as many of these DATA lines as you need to the bottom of the program. Two cautions, however. First, to avoid CURSOR OUT OF RANGE errors, don't try to plot a line off the screen. This means the largest number in your DATA statements must never exceed the value you assign to YSCALE, and likewise the number of data elements must never exceed the value assigned to XSCALE.

Second, to avoid OUT OF DATA errors, always make the very last data element a dummy element, a "flag." A flag is a number which signals something to a computer. In this case, the flag signals the Atari that there is no more data to be read. It then leaves the READ DATA subroutine and finishes the program. The flag is a number (any number) which exceeds the value you assigned to YSCALE (I just told you never to exceed YSCALE, but the program expects it in this case). In the example below, I chose the number 101 as my flag (YSCALE = 20).

The flag also serves another very important purpose. It permits you to draw more than one line at a time on your chart. Again, refer to the example program: It charts two lines for stock prices of two companies. To do this yourself, add a flag to the end of the last DATA statement which draws the first line, then add more DATA statements to chart the second line. Using my investment example, the rates for the first company are in DATA lines 2300 – 2340, and the rates for the second company are in DATA lines 2360 – 2400. You'll notice that each of these series of DATA lines ends with a flag of 101. For each line drawn on the chart, you also need a GOSUB 1500 near the top of the program. Mine are at lines 420 and 440.

You aren't lost, are you? Well, just in case, here's how I would add a third line to my chart. First, I would insert a GOSUB 1500 at line 470. Then, I would put the data in new DATA statements after line 2400, ended with a flag of 101.

To plot just one line, I would delete the GOSUB at line 440 and the DATA at lines 2360 – 2400. It's really very simple if you'll type in the example program and see how it works.

How To Fib With Statistics

Play with my example program a bit before modifying it for your own purposes. Make XSCALE = 104 (2*52) and XMARKERS = 8 (2*4) to draw a two-year chart with weekly and quarterly indices. Or, to draw a three-year chart, make XSCALE = 156 (3*52) and XMARKERS = 12 (3*4).

Incidentally, if your computer is hooked up to a regular TV instead of a monochrome computer monitor, you'll probably experience a phenomenon known as "artifacting" when you try to draw a two- or three-year chart. TV sets lack the resolution necessary to display very fine lines drawn very close together. The week markers along the top and bottom of the chart will merge and create unusual colors not normally possible in the one-color GRAPHICS 8 mode. Some programs use this effect — artifacting — to advantage. In this program, however, it will obscure the lines you're trying to draw. You can avoid this by plotting fewer markers: For a two-year chart, make XSCALE = 24 (2*12) to plot by the month rather than by the week. Even if artifacting obscures your indices, though, it will not affect the charted lines of data.

Now, before I explain how to dress up the chart with custom labels, take a few minutes to experiment with these values a moment longer, and you'll see how less-than-honest statisticians could tinker with chart scales to manipulate the unwary. For instance, change YSCALE to 18 and YMARKERS to 3.6 while using the same DATA numbers (ignore the "$5", "$10", and "$15" labels, which now will be mislocated). RUN the program. See how steep the charted lines appear, with high peaks and low valleys? Looks like those stock prices are pretty undependable from week to week, right?

But now change YSCALE to 60 and YMARKERS to 12 (again ignoring the labels), and RUN. Now the lines magically flatten out, and it looks like the prices hardly changed all year.

We used the same DATA numbers, remember, and numbers don't lie — but they can mislead. For example, a politician running for sheriff can make a chart dramatizing that crime rates have sharply climbed during his opponent's term of office, while the opponent can plot the very same numbers on a compressed-scale chart and it will appear that the rates have hardly climbed at all. This program can animate such manipulations and make them graphically obvious.

Text On The Hi-Res Screen

Besides the text window title ("Price-Per-Share Stock Chart 1984" in this example), a special subroutine at line 1160 prints anything you want in GRAPHICS 0-style text anywhere inside the GRAPHICS 8 graphics window. (You may want to separately save this subroutine using the LIST command to use in your own programs.) Options built into this subroutine let you display your labels almost any way you want, horizontally and even diagonally.

Here's how to use this subroutine. First, define your label as ZA$ in a line number that immediately follows the GOSUB 1500 which reads the associated DATA. Again, refer to the example program. The GOSUB at line 420 reads the first three lines of DATA for the first company's stock prices. Therefore, ZA$ is defined in line 430 as

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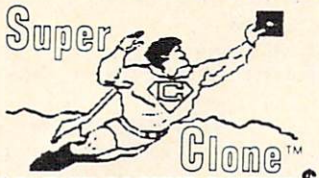

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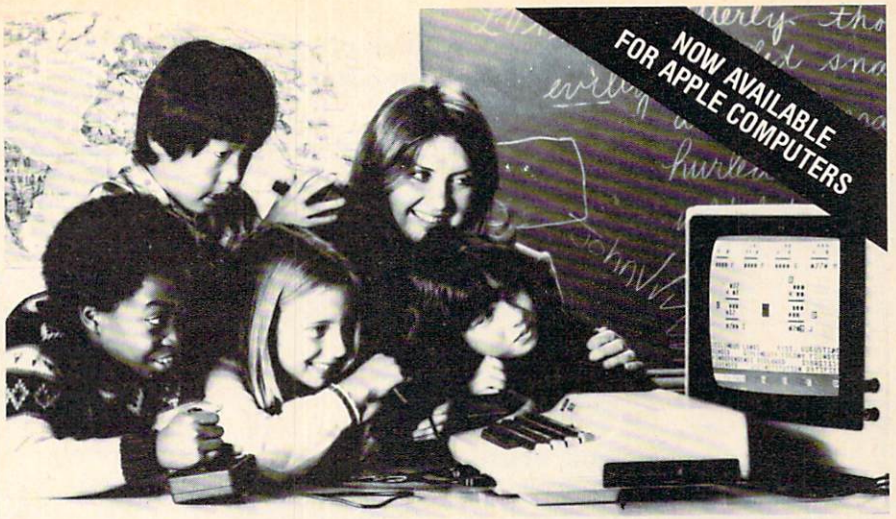

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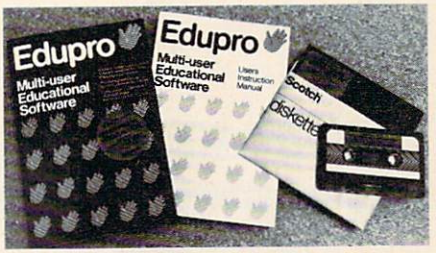

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Figure 1: A commercial screen-dump program was used to reproduce this one-year chart created with "Chartmaker."

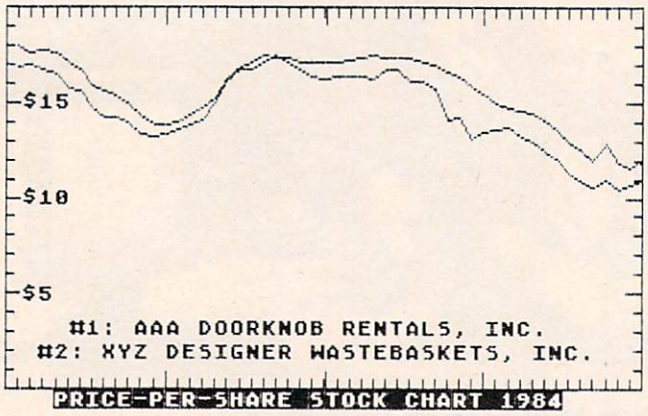
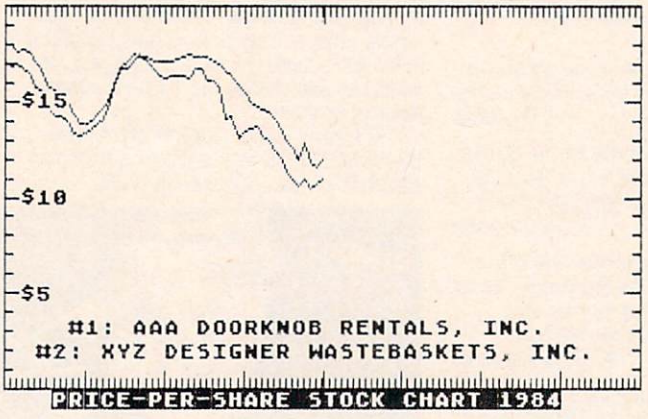


Figure 2: A two-year chart using the same data as the one-year chart.



"#1:AAA DOORKNOB RENTALS, INC." When RUN, the program writes this label just after the line of stock prices for this company is plotted.

Next, the GOSUB 1500 at line 440 plots the stock prices for the second company. Then, ZA$ is redefined in line 460 as "#2: XYZ DESIGNER WASTEBASKETS, INC.", and this label is drawn. Lines 480, 500, and 520 redefine ZA$ three more times to display dollar labels on the chart. The GOSUB 1160 added onto the ends of all these lines sends the program off to the text subroutine.

Options are chosen by the three variables which must always follow any definition of ZA$. ZX positions the label horizontally on the screen (the X axis); this is a column number from 0 to 39. ZY likewise positions the label vertically on the screen (the Y axis); it is a number from 0 to 191. And, finally, ZZZ is the slant of the label. If ZZZ = 0, as in the example program, the labels are written horizontally. If ZZZ = 1 or if ZZZ = −1, the label is displayed with a right or left diagonal tilt.

By modifying this program in all these ways to display your own text labels and scales, you can adapt it to quite a wide range of uses.

Chartmaker

```
40 XCOORD=319:YCOORD=159
50 XSCALE=52:YSCALE=20
60 XMARKERS=4:YMARKERS=4
80 POKE 82,0:GRAPHICS 8:COLOR 1:POKE
   710,0:DIM ZA$(50)
120 PLOT 0,0:DRAWTO 0,YCOORD:DRAWTO
   XCOORD,YCOORD:DRAWTO XCOORD,0:DR
   AWTO 0,0:GOSUB 2000
400 POKE 752,1:? "{3 SPACES}PRICE-PE
   R-SHARE STOCK CHART 1984"
420 GOSUB 1500
430 ZA$="#1: AAA DOORKNOB RENTALS, I
   NC.":ZX=4:ZY=130:ZZZ=0:GOSUB 116
   0
440 GOSUB 1500
460 ZA$="#2: XYZ DESIGNER WASTEBASKE
   TS, INC.":ZX=2:ZY=140:ZZZ=0:GOSU
   B 1160
480 ZA$="$15":ZX=1:ZY=36:ZZZ=0:GOSUB
    1160
500 ZA$="$10":ZX=1:ZY=76:ZZZ=0:GOSUB
    1160
520 ZA$="$5":ZX=1:ZY=116:ZZZ=0:GOSUB
    1160
1140 GOTO 1140
1160 REM *** DISPLAY TEXT IN GR.8 **
   *
1170 ZL=PEEK(560)+PEEK(561)*256
1180 ZM=PEEK(ZL+4)+PEEK(ZL+5)*256
1200 FOR ZW=1 TO LEN(ZA$)
1220 ZT=57344+((ASC(ZA$(ZW,ZW))-32)*
   8)
1240 ZC=ZM+ZY*40+ZX+(ZW-1)
1260 FOR ZR=0 TO 7
1280 POKE ZC+ZR*40,PEEK(ZT+ZR)
1300 NEXT ZR
1320 ZY=ZY+ZZZ
1340 NEXT ZW
1360 RETURN
1500 REM *** READ DATA, PLOT LINES *
   **
1510 I=0:X=0:Y=0
1520 READ Y
1540 IF Y>YSCALE THEN RETURN
1560 Y=YCOORD-Y*(YCOORD/YSCALE)
1580 X=X+XCOORD/XSCALE
1600 IF I=0 THEN PLOT X,Y
1620 DRAWTO X,Y:I=I+1:GOTO 1520
2000 REM *** DRAW SCALES ***
2040 FOR I=0 TO YCOORD STEP YCOORD/Y
   SCALE:PLOT 4,I:DRAWTO 0,I:NEXT
   I:REM LEFT
2060 FOR I=0 TO YCOORD STEP YCOORD/Y
   SCALE:PLOT 315,I:DRAWTO XCOORD,
   I:NEXT I:REM RIGHT
2080 FOR I=0 TO XCOORD STEP XCOORD/X
   SCALE:PLOT I,4:DRAWTO I,0:NEXT
   I:REM TOP
2100 FOR I=0 TO XCOORD STEP XCOORD/X
   SCALE:PLOT I,155:DRAWTO I,YCOOR
   D:NEXT I:REM BOTTOM
2120 REM *** DRAW X & Y MARKERS ***
2140 FOR I=0 TO YCOORD STEP YCOORD/Y
   MARKERS:PLOT 8,I:DRAWTO 0,I:NEX
   T I:REM LEFT
2160 FOR I=0 TO YCOORD STEP YCOORD/Y
   MARKERS:PLOT 311,I:DRAWTO XCOOR
   D,I:NEXT I:REM RIGHT
2180 FOR I=0 TO XCOORD STEP XCOORD/X
   MARKERS:PLOT I,7:DRAWTO I,0:NEX
   T I:REM TOP
```

```
2200 FOR I=0 TO XCOORD STEP XCOORD/X
     MARKERS:PLOT I,152:DRAWTO I,YCO
     ORD:NEXT I:REM BOTTOM
2220 RETURN
2300 DATA 17.95,17.65,17.72,17.56,17
     .07,16.72,15.84,15.55,15.38,15,
     14.32,13.89,13.8,13.98,14.31,14
     .71,15.26,16.17
2320 DATA 16.86,17.16,17.45,17.30,17
     .30,17.06,17.12,17.12,17.12,17.
     23,17.34,17.46,17.32,17.38,17.3
     4,17.07,17.04,16.62
2340 DATA 16.38,15.88,15.45,14.99,14
     .74,14.62,14.5,14.11,13.60,12.9
     6,12.62,12.01,12.84,11.85,11.55
     ,11.92,101
2360 DATA 16.86,16.96,16.76,16.5,15.
     78,15.62,14.67,14.27,14.2,13.98
     ,13.37,13.27,13.29,13.54,13.83,
     14.09,15,16.04
2380 DATA 16.79,16.75,17.16,17.45,17
     .12,16.72,16.32,16.21,16.32,16.
     41,16.29,16.25,16.75,16.73,16.1
     5,16.10,15.72,14.10
2400 DATA 14.25,13.05,13.47,13.61,13
     .74,13.18,12.96,12.43,12.03,11.
     36,10.89,10.62,10.89,10.49,10.6
     9,10.96,101
```

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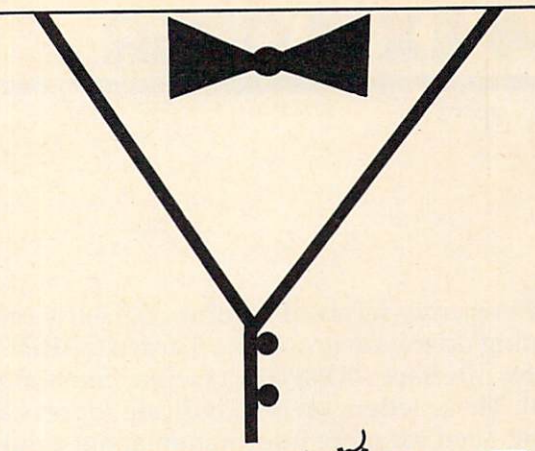

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64 EXPLORER

Larry Isaacs

I have recently received a number of letters commenting on my review of the Cardco CARD/? printer interface (COMPUTE!'s Gazette, September 1983). These letters seem to indicate there is a strong need for more information about printers and printer interfaces. Perhaps this topic is worth a second look.

Keeping Up-To-Date

Unfortunately, when reviewing printers and printer interfaces, the reviewer has a special problem because this area is one of the most competitive and fastest changing in the computer industry. All printers these days have one or more microprocessors. This means that the manufacturer can add features in many cases simply by modifying or adding software in the printer.

Realistically, there are always limits, so each manufacturer must choose what features will be incorporated based on what current technology will allow. But with technology improving rapidly, printers have also been improved rapidly. This makes it tough for the reviewer to keep his comments up-to-date.

The rapidly changing world of printers also makes it tough on those trying to buy one. However, some basic information on printers always applies regardless. For microcomputers, there are two basic types of printers: The first is the *dot-matrix* printer, which prints each character as an array of dots; the second is the *letter-quality* printer, which prints fully formed characters like a typewriter. For the 64, you would typically want to go with a dot-matrix printer. Most newer dot-matrix printers can also print graphics images in addition to printing text. However, if you really needed your output to look as if it were typed, you might want to purchase a letter-quality (or daisy wheel) printer. However, many dot-matrix printers have a print mode which produces a very readable "correspondence" quality output. You will need to judge for yourself if the print quality is sufficient for your needs.

As I see it, printers are competing in three main areas: price, performance (primarily printing speed), and number of features. Today there are many printers available, ranging from low-priced units with slow speed and a few basic features to more expensive units with higher speed and added features.

What's Right For You?

To help decide what printer to buy, you need to form some idea of what your needs are. If you primarily need a printer for printing an occasional BASIC listing, you could certainly settle for a less expensive printer with simple features.

Perhaps a 40-column unit, which is typically less expensive than 80- or 132-column units, would meet your needs. If you plan to use your 64 for word processing, you might want to consider a printer with more features. You will also need to make sure the printer is compatible with the word processor you use. If you plan to do a lot of program development, speed and ruggedness are important features.

Deciding On Price

Once you have some idea of your needs, you should determine a price range. This will help narrow your choices a little further, and you can begin investigating specific printers. I recommend giving a little more consideration to the printers at the upper end of your price range since greater performance is more likely.

One of the most fundamental considerations you'll have is whether or not to buy a Commodore printer. There are several advantages to doing so. First, the printer is designed to work with the 64. Second, you can be pretty certain that any 64 software package that uses a printer will be compatible with a Commodore printer. And third, the printer can be serviced at the same place as your 64 and other Commodore peripherals.

The disadvantage of buying a Commodore printer is that since Commodore doesn't specialize in printers, other manufacturers may offer printers with more features or better prices. However, if you do choose a non-Commodore printer, there will be some compatibility problems, the extent of which depends on the printer. You must also consider that a printer interface will likely be needed to connect the printer to the 64 (more about this later). Fortunately, the popularity of the 64 provides strong encouragement to competing manufacturers to make printers compatible with the 64 and VIC-20.

Other Considerations

How much importance should you place on special features? Typically, the more features the

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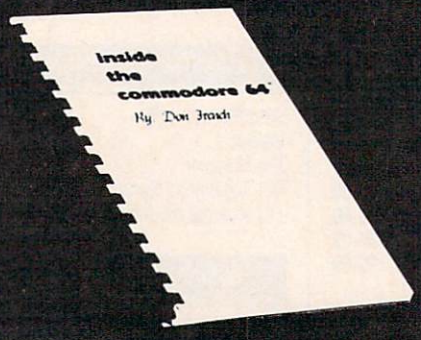
Inside the Commodore 64



This step-by-step guide to machine language and assembly language programming will teach you what you don't already know and assist you to use what you do. Combined with the integrated set of software tools of Develop-64, it makes the ideal development system.

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better, though there may be some features you'll never use. Ultimately, you may have to determine how much the extra features will actually cost you and whether a less expensive printer with fewer features is more appropriate.

One of the most difficult yet most important considerations is the printer's reliability. In some cases, the printer might have problems with overheating or even breaking down if used for an extended period. The latter problem is much more common since it can be caused by minor imperfections in a couple of important components — imperfections hard to detect before purchase. But if you don't plan on generating that much output, this won't be of great concern.

Newer printers will likely offer advantages in price, performance, and features. The disadvantage is that they may not have a proven track record. One feature you will typically find only on newer printers is the ability to print different colors, but don't expect the colors you see on the 64 screen to appear automatically on the printer. It will take software to make that happen. If you want to be really daring, you could consider some of the relatively inexpensive (that is, under $1000) ink-jet printers that are starting to appear. These form a dot-matrix character by guiding little dots of ink to the proper location on the paper.

If you decide to buy a non-Commodore printer, you will probably need a printer interface to connect the printer to the 64. With printer interfaces, you will mostly be comparing price versus number of features. The units with more features will have more ROM to hold extra software, hence a higher cost. When deciding on one, determine which has at least enough features to meet your needs.

When you are thorough with your investigation of printers, you should be able to make a wise choice. Finding a printer which serves your needs well will keep the grass from looking too much greener on the other side when new printers come along. ©

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COMPARING COMMODORE MACHINE LANGUAGE PROGRAMS

Harvey B. Herman, Associate Editor

This BASIC program compares two machine language programs on disk and displays the differences. Advanced programmers will find this a useful utility — as will beginners, who can refer to the explanatory REMs included in the program. For Commodore, but can be adapted to other computers.

I love to tinker. When someone sends me a machine language (ML) program which requires modifications to work effectively on my system, I wade right in and make changes. Writing an extensive ML program may be beyond me, but reworking someone else's is a piece of cake. The only problem I have is keeping track of which version has what modification.

If you love to tinker or are just curious about the difference between updates on commercial software, then the program discussed here should be helpful. It was written on a Commodore 8032 with a 2031 single disk drive, but should work with other Commodore equipment without much modification. You could probably make it work on other computers if your disk operating system allows GETting individual bytes of a machine language program.

The program, "Comparing ML Programs," is a BASIC program which displays the differences between two ML programs saved on disk. A sample output comparing two versions of an Invaders program is included. My "patch," jumping out of the code to unused locations, can be clearly seen. Of course, I could laboriously go through the disassembled listings of each version and find the modifications by inspection, but this computer program is designed to do that automatically, much faster than by hand, and with less eyestrain.

Program Operation

The program operation is not difficult to understand. It POKEs both ML programs from disk(s) into high memory and then compares them byte for byte. Any differences are output to the screen or printer. I have included REMarks in the program listing to help the first-time user, but the following additional comments may be helpful:

1. Program a is stored from $2000 – $4FFF (max).
2. Program b is stored from $5000 – $7FFF (max).
3. The programs may be on different disks.
4. The programs do not need to start at the same address.
5. The first two bytes of programs give load address information and are not POKEd into memory.
6. Load address information is, however, shown as part of the output.
7. If the programs are not the same size, the output of differences shows asterisks for the shorter program.
8. Timing data (TI$) is output to the screen.

You may wonder at the last comment. The program, written as it is in BASIC, is comparatively slow — comparing the Invaders programs took almost 15 minutes. But this program is not used every day, only when you need it. More importantly, I have used it often to compare much smaller programs where execution time is not a significant factor. Some parts of the program could be sped up by ML segments, but I did not feel it was worth the trouble for me. Perhaps you would like to try this and share the results.

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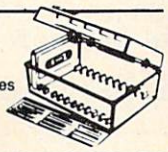

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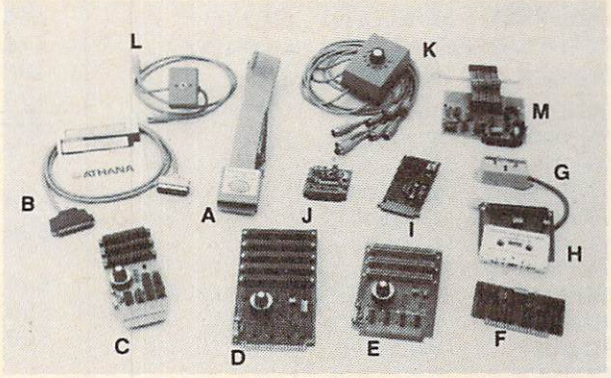

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Sample Output

```
INVADERS1 — START 0401   END 1FFF
INVADERS2 — START 0401   END 1FFF
INVADERS1     INVADERS2
1994 :0024    1994 :00C9
1995 :0024    1995 :0053
1996 :0024    1996 :00D0
1997 :0024    1997 :0003
1998 :0024    1998 :004C
1999 :0024    1999 :0016
199A:0024     199A:00FD
199B :0024    199B :004C
199C :0024    199C :00C0
199D:0024     199D:0016
19C1:00C0     19C1:0094
19C2:0016     19C2:0019
```

Comparing Machine Language Programs

```
140 POKE53,32:POKE52,0:CLR:REM PROTECT $2
    000 UP
150 PRINT"{CLR}{RVS}COMPARE TWO FILES":PR
    INT
155 INPUT "OUTPUT - {RVS}S{OFF}CREEN OR
    {RVS}P{OFF}RINTER{3 SPACES}P{3 LEFT}"
    ;A$
160 IF LEFT$(A$,1)="S" THEN DE=3:GOTO 190
170 IF LEFT$(A$,1)="P" THEN DE=4:GOTO 190
    :REM PRINTER DEVICE 4
180 GOTO 150
190 PRINT "INSERT DISK WITH PROGRAM A - H
    IT ANY KEY"
200 GET A$:IF A$="" THEN 200
210 INPUT "FILE A NAME{2 SPACES}
    {SHIFT-SPACE}{3 LEFT}";B$(1):IF B$(1)
    ="{SHIFT-SPACE}" THEN 210
220 PRINT TI$
230 OPEN 1,8,3,"0:"+B$(1)+",P,R"
240 IF DS<>0 THEN PRINT DS$:STOP
250 OPEN2,DE:PRINT#2
260 N=2:GOSUB 680:S1=L1:E1=L1+(M-N*4096):
    REM FILE A STORED FROM 2*4096 UP
270 PRINT#2,B$(1);" - START ";
280 LL=S1:GOSUB 830:PRINT#2,"{2 SPACES}EN
    D ";:LL=E1:GOSUB 830:PRINT#2
290 PRINT TI$
300 PRINT "INSERT DISK WITH PROGRAM B - H
    IT ANY KEY"
310 GET A$:IF A$="" THEN 310
320 INPUT "FILE B NAME{2 SPACES}
    {SHIFT-SPACE}{3 LEFT}";B$(2):IF B$(2)
    ="{SHIFT-SPACE}" THEN 320
330 PRINT TI$
340 OPEN 1,8,3,"0:"+B$(2)+",P,R"
350 IF DS<>0 THEN PRINT DS$:STOP
360 N=5:GOSUB 680:S2=L1:E2=L1+(M-N*4096):
    REM FILE B STORED FROM 5*4096 UP
370 PRINT#2,B$(2);" - START ";
380 LL=S2:GOSUB 830:PRINT#2,"{2 SPACES}EN
    D ";:LL=E2:GOSUB 830:PRINT#2:PRINT#2
390 PRINT TI$
400 REM Q=MAX(E1-S1,E2-S2)
410 Q=-((E1-S1)>=(E2-S2))*(E1-S1)-((E2-S2
    )>(E1-S1))*(E2-S2)
420 PRINT#2,B$(1);TAB(15+(DE=4)*LEN(B$(1)
    ));B$(2):PRINT#2
430 REM MAIN COMPARE
440 F=0:J=2*4096:K=5*4096
450 REM F=0/NO DIFFERENCE{2 SPACES}FILE A
    /$2000 UP{3 SPACES}FILE B/$5000 UP
460 FOR I=0 TO Q
470 A=PEEK(J):J=J+1
480 B=PEEK(K):K=K+1
490 IF S1+I<=E1 THEN 540
500 REM FILE B > FILE A
510 LL=S1+I:GOSUB 830:PRINT#2," : ";"****
    ";"{4 SPACES}";
520 LL=S2+I:GOSUB 830
530 PRINT#2," : ";:LL=B:GOSUB 830:PRINT#2
    :F=1:GOTO 640
540 IF S2+I<=E2 THEN 590
550 REM FILE A > FILE B
560 LL=S1+I:GOSUB 830:PRINT#2," : ";:LL=A
    :GOSUB 830
570 PRINT#2,"{4 SPACES}";
580 LL=S2+I:GOSUB 830:PRINT#2," : ";"****
    ":F=1:GOTO 640
590 IF A=B THEN 640
600 LL=S1+I:GOSUB 830:PRINT#2," : ";:LL=A
    :GOSUB 830
610 PRINT#2,"{4 SPACES}";
620 LL=S2+I:GOSUB 830:PRINT#2," : ";:LL=B
    :GOSUB 830
630 PRINT#2:F=1
640 NEXT I
650 IF F=0 THEN PRINT "***{RVS}NO DIFFERE
    NCE{OFF}***"
660 PRINT#2:CLOSE2:PRINTTI$:END
670 REM POKE FILE A/B TO MEMORY
680 M=N*4096:Q=M+3*4096:REM M/Q START/MAX
     LAST LOCATION
690 GET#1,L$:GET#1,H$
700 IF L$="" THEN L=0:GOTO 720
710 L=ASC(L$)
720 IF H$="" THEN H=0:GOTO 740
730 H=ASC(H$)
740 L1=256*H+L
750 GET#1,V$
760 IF V$="" THEN POKEM,0:GOTO 780
770 POKEM,ASC(V$)
780 IF ST<>0 THEN CLOSE 1:RETURN:REM END
    {SPACE}OF FILE
790 REM SAFETY CHECK FOR TOO LARGE FILES
800 M=M+1:IF M>Q THEN PRINT "FILE TOO LAR
    GE":CLOSE 1:STOP
810 GOTO 750
820 REM DECIMAL TO HEX
830 LL=LL/4096:FOR JJ=1 TO 4:LL%=LL:PRINT
    #2,CHR$(48+LL%-(LL%>9)*7);
840 LL=16*(LL-LL%):NEXT JJ:RETURN:REM JIM
     B.
```

Note To 64 Users

To use "Comparing ML Programs" with the 64, change the following lines:

```
140 POKE53,64:POKE52,0:CLR
260 N=4:GOSUB680::S1=L1:E1=L1+(M-N*409
    6)
360 N=8:GOSUB680:S2=L1:E2=L1+(M-N*4096
    )
440 F=0:J=4*4096:K=8*4096
680 M=N*4096:Q=M+4*4096
```

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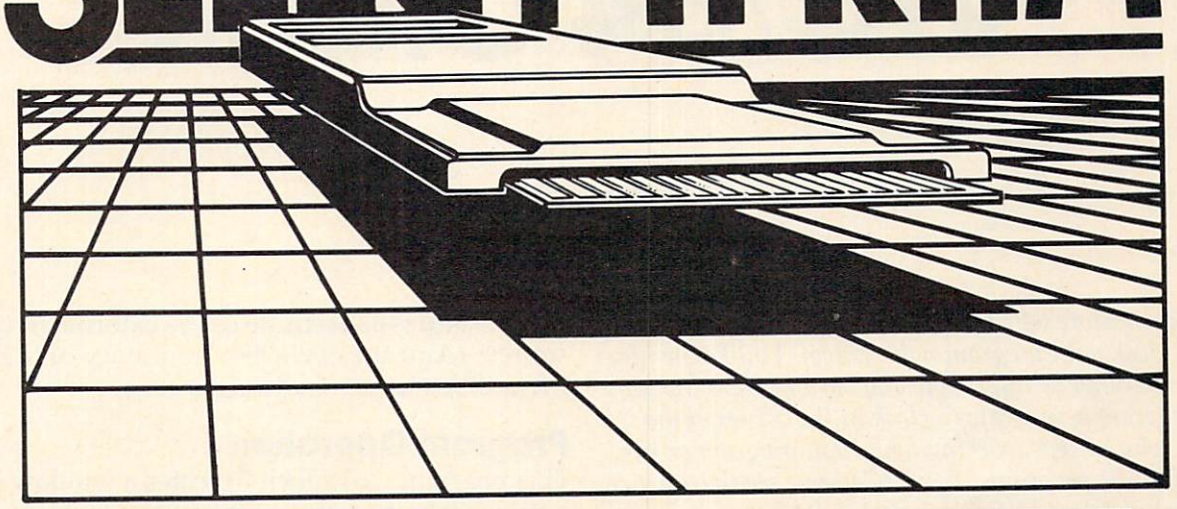
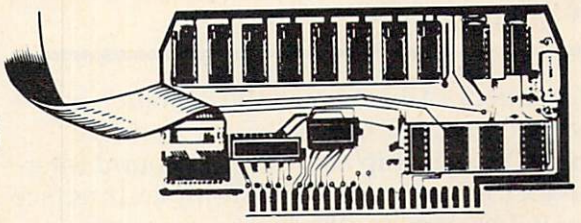
64K for VIC 20™

SELECT·A·RAM™



SELECT·A·RAM



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VIC/64 Clock

Paul F. Schatz

The Commodore 64's CIA chip features a 24-hour time-of-day clock with programmable alarm. Unlike the jiffy clock, it cannot be interrupted by various I/O functions. The program here creates a clock in the corner of the screen which keeps working while you program or run other BASIC programs. For VIC users, see the accompanying article, "VIC Clock."

Since Commodore introduced the 64, much has been written on the 6566/6567 Video Interface Controller (VIC-II) chip and the 6581 Sound Interface Device (SID) chip. The 6526 Complex Interface Adapter (CIA) chip, another new integrated circuit, introduced with the 64, has largely been ignored. This chip supersedes the 6522 Versatile Interface Adapter (VIA) used in previous Commodore computers. The CIA has several additional features not in the VIA, one of them a 24-hour time-of-day (TOD) clock with programmable alarm.

How The Time-Of-Day Clock Works

The TOD clock consists of four memory registers organized into hours, minutes, seconds, and tenths of seconds. The CIA continuously updates these registers based on an external frequency source. Like most commercial digital clocks, the CIA chip uses the 60 cycles/second (60 Hz) frequency of the voltage in household electric power lines as a source.

The TOD clock is very different from the jiffy clock, which is referenced by the BASIC variables TI and TI$. The jiffy clock is updated by a carefully timed sequence of instructions in the interrupt service routine of the computer. If the interrupt routine is suspended (as, for example, during cassette loads or saves) or altered, the jiffy clock loses its accuracy. On the other hand, the timing for the TOD clock is independent of the interrupt routine and is as accurate as the external frequency source. (And the 60Hz line frequency of U.S. electric utilities is extremely accurate.)

Program Operation

This program, "64 Clock," creates a window in the upper-left corner of the screen in which the time is continuously displayed. The machine language program hooks into the interrupt routine, so the display is updated every 1/60 second. After the clock display has been set up and started, other BASIC programs can be run while the clock ticks away. The only limitation is that your program must alter the interrupt pointers.

There are two parts to the program. Lines 10 – 180 set up the machine language routine for the display window. Lines 200 – 530 set the time on the clock. When a number is written into the hours register (line 270), the TOD clock stops and does not restart until a number is written into the tenths-of-a-second register (line 370). The numbers in the TOD registers are in binary coded decimal (BCD) format. Lines 500 – 530 are a subroutine for converting the input data into the proper format for setting the TOD registers.

The default colors for the window display are standard screen color for the characters and white for the background. Thus, if the screen is white, the characters will not be visible. The background color can be changed by entering:

```
POKE 49263, <color>
```

where <color> is the number corresponding to one of the 16 colors available on the 64. The position of the window can be changed by entering:

```
POKE 49207, <column>
```

where <column> is the number of the column where the window starts. If <column> is 0, the window is in the upper-left corner. If <column> is

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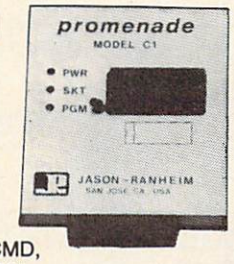

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VIC Clock

Charles Brannon, Program Editor

The Commodore 64's CIA chip is easily programmable for 24-hour time. The timekeeping is independent of any of the computer's other functions. The VIC-20 is equally capable of keeping time, but it has to be done with software.

Every 60th of a second, the VIC's own VIA chip causes an *interrupt*. An interrupt does what the name implies: The 6502 microprocessor stops whatever it's doing and goes on to execute a special interrupt routine. After the interrupt routine is finished, the interrupted program resumes.

During the interrupt, the VIC performs certain "housekeeping" functions. It reads the keyboard, converts the *keyscan code* to normal Commodore ASCII, then places this value in the keyboard buffer. The interrupt also flashes the cursor. And each time the interrupt is called, the interrupt routines increment the *realtime clock*.

The realtime clock uses three memory locations: 160, 161, and 162. The time is stored in sixtieths of a second, since the clock is updated every sixtieth of a second. But a memory location can only hold a value from 0-255, so three locations are used. Every time location 162 wraps around to zero (approximately every four seconds), location 161 is incremented, and when 161 wraps around to zero, location 160 is bumped up by one. Note that the order of the bytes is backward compared to the normal 6502 convention, where the *most significant byte* (the one that goes up after the least significant byte wraps around to zero) follows the least significant byte.

You can read the realtime clock in BASIC without worrying about the memory locations. Two *reserved variables*, TIME and TIME$, always return the current time. The numeric variable TIME returns the time in sixtieths of a second, and is equivelent to PEEK(160)+PEEK(161)*256+PEEK(162)*65536. You can divide it by 60 to get the time in seconds. You cannot change TIME directly, as in TIME=0, but you can change TIME$ and that will cause TIME to change.

TIME$ is a string holding a six-digit number. The format (as in TIME$="041020") is HHMMSS, where HH is the hours, MM is minutes, and SS is seconds. You must "pad out" unused digits with a zero (01 for one hour). You can directly set TIME$, and print out the time with PRINT TIME$. TIME$ is a 24-hour clock, as in military time, so any hour after noon has 12 added to it. To set the clock to 10:30 a.m. you would write: TIME$="103000", but you would use TIME$="172500" for 5:25 p.m. At midnight, TIME$ wraps around to "000000". Once you set the time, it keeps counting automatically. Incidentally, you can abbreviate the variables to TI and TI$.

A Few Caveats

There are a few things to look out for when using this software-updated clock. If the interrupt routine is disabled, then it doesn't have the opportunity to update the clock. Cassette input/output uses the VIA chip for its own purposes, preventing its use for the normal system interrupts. Therefore, the system clock stops during tape I/O and restarts after the tape access is finished. If you are using the clock to keep the time of day, it will lose as much time as the tape routines take. There is no way around this, so keep it in mind.

It may be convenient to have the time always displayed. Program 2, "VIC Clock," lets you do this. You have the option of starting the clock, stopping it, clearing it, and setting the time. The clock is always displayed in the upper left-hand corner of the screen, and nothing will erase it, not even screen scrolls or clears. The displayed clock is separate from the normal realtime clock variables, TI and TI$, so you can still use them in your program. The clock is added to the interrupt routine discussed above (so it will not update during tape routines either). If you want to turn off the visible clock, just press RUN/STOP-RESTORE.

Look at Program 2 for some details on using the clock and function keys. You can stop the clock with POKE 997,1 and start it with POKE 997,0. You can also change the color of the clock digits by POKEing 996 with the same color as you would put into color memory, 0–7.

28, the window is in the upper-right corner. The display may be turned off and on without affecting the time. To turn on the display, enter SYS 49155. To turn off the display, enter SYS 49152. The display may also be turned off by pressing the RUN/STOP and RESTORE keys simultaneously.

Since there are two CIA chips built into the 64, it is possible to have two TOD clocks. It is also

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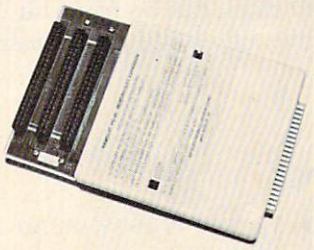

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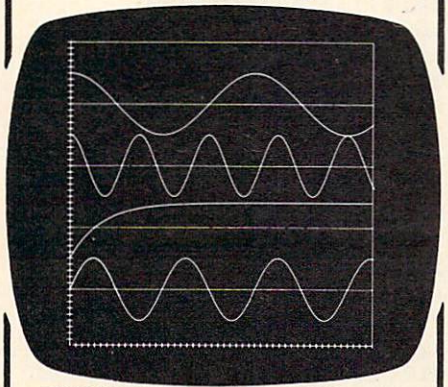

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C-12

possible to set an alarm on the TOD clock which triggers an interrupt. More information on the CIA chip and the TOD clock can be found in Appendix M of the *Commodore 64 Programmer's Reference Guide.*

Program 1: 64 Clock

```
10 A=0: FOR I = 49152 TO 49296: READ J: P
   OKE I, J: A = A+J: NEXT I
20 IF A<>16834 THEN PRINT "ERROR IN DATA
   {SPACE}STATEMENTS": END
30 PRINT "{CLR}{DOWN}{RVS}CLOCK FOR C64
   {OFF}"
40 PRINT: PRINT "TO SET THE CLOCK - RUN 2
   00"
50 PRINT "TO CHANGE THE COLOR - POKE 4926
   3,COLOR"
60 PRINT "TO BLANK CLOCK DISPLAY - SYS 49
   152"
70 PRINT "TO ACTIVATE DISPLAY - SYS 49155
   "
80 SYS 49155
90 END
100 DATA 76, 30,192,120,173, 20, 3,141, 2
    8,192,169, 45,141, 20, 3,173, 21
110 DATA 3,141, 29,192,169,192,141, 21, 3
    , 88, 96, 49,234,120,173, 28,192
120 DATA141, 20, 3,173, 29,192,141, 21, 3
    , 88, 96,173, 24,208, 41,240, 74
130 DATA 74,133,254,169, 0,133,253,160, 0
    ,173, 11,220, 72, 41,127,162,186
140 DATA 32,120,192,173, 10,220, 32,120,1
    92,173, 9,220,162,174, 32,120,192
150 DATA173, 8,220, 32,137,192,104, 16, 3
    ,169,144, 44,169,129, 32,141,192
160 DATA169,141,145,253,169,216,133,254,1
    69, 1,145,253,136, 16,251,108, 28
170 DATA192, 72, 32,133,192,104, 32,137,1
    92,138, 32,141,192, 96, 74, 74, 74
180 DATA 74, 41, 15, 9,176,145,253,200, 9
    6
200 REM CLOCK SETTING ROUTINE
210 PRINT "{CLR}{DOWN}{RVS}SET THE CLOCK
    {SPACE}": PRINT
220 POKE 56335, PEEK(56335) AND 127: REM
    {SPACE}SET TIME OF DAY CLOCK
230 INPUT "AM OR PM"; A$
240 A=128: IF LEFT$(A$,1)="A" THEN A = 0
250 INPUT "HOUR"; A$: IF LEN(A$)>2 THEN P
    RINT "ERROR": GOTO 250
260 GOSUB 500: IF N>18 THEN PRINT "ERROR"
    : GOTO 250
270 POKE 56331, A+N: REM SET HOURS
280 INPUT "MINUTES"; A$: IF LEN(A$)>2 THE
    N PRINT "ERROR": GOTO 280
290 GOSUB 500: IF N>89 THEN PRINT "ERROR"
    : GOTO 280
300 POKE 56330, N: REM SET MINUTES
310 INPUT "SECONDS"; A$: IF LEN(A$)>2 THE
    N PRINT "ERROR": GOTO 310
320 GOSUB 500: IF N>89 THEN PRINT "ERROR"
    : GOTO 310
330 POKE 56329, N: REM SET SECONDS
340 PRINT "WHEN YOU ARE READY TO START TH
    E CLOCK,"
350 PRINT "PRESS ANY KEY."
360 GET A$: IF A$=""THEN 360
370 POKE 56328,0: REM START CLOCK
380 END
500 IF LEN(A$)=1 THEN T=0: GOTO 520
510 T = VAL(LEFT$(A$,1))
520 U = VAL(RIGHT$(A$,1))
530 N=16*T+U: RETURN
```

Program 2: VIC Clock

by Charles Brannon, Program Editor

```
100 PRINT"{CLR}{RVS}PLEASE WAIT"
110 FORI=828TO995:READA:POKEI,A:CK=CK+A:N
    EXT
120 IFCK<>20518THENPRINT"{HOME}ERROR IN D
    ATA STATEMENTS":END
125 SYS828
130 PRINT"{CLR}{4 SPACES}{4 DOWN}CHOOSE:
    {DOWN}"
140 PRINT"{4 SPACES}{RVS}{YEL}F1{OFF}:
    {BLU}STOP CLOCK"
150 PRINT"{DOWN}{4 SPACES}{RVS}{RED}F3
    {OFF}{BLU}:START CLOCK"
160 PRINT"{DOWN}{4 SPACES}{RVS}{PUR}F5
    {OFF}{BLU}:CLEAR CLOCK"
165 PRINT"{DOWN}{4 SPACES}{RVS}{GRN}F7
    {OFF}:{BLU}SET TIME"
170 GETA$:IFA$<CHR$(133)ORA$>CHR$(136)THE
    N170
180 ON ASC(A$)-132 GOTO 190,240,250,200
190 POKE 997,1:GOTO 170
200 POKE997,1:INPUT"{CLR}{2 DOWN}HOURS? 0
    0{4 LEFT}";H$:IFLEN(H$)<>2THEN200
210 INPUT"MINUTES? 00{4 LEFT}";M$:IFLEN(M
    $)<>2THEN210
220 INPUT"SECONDS? 00{4 LEFT}";S$:IFLEN(S
    $)<>2THEN220
230 T$=H$+M$+S$+"00":FORI=1TO8:POKE998+I,
    ASC(MID$(T$,I)):NEXT:GOTO130
240 POKE997,0:GOTO170
250 SYS851:POKE997,1:GOTO170
828 DATA 173,020,003,141,226,003
834 DATA 173,021,003,141,227,003
840 DATA 120,169,098,141,020,003
846 DATA 169,003,141,021,003,169
852 DATA 048,162,009,157,230,003
858 DATA 202,208,250,142,229,003
864 DATA 088,096,173,229,003,208
870 DATA 053,162,008,024,189,230
876 DATA 003,105,001,141,228,003
882 DATA 201,058,208,005,169,048
888 DATA 141,228,003,138,041,001
894 DATA 240,012,173,228,003,201
900 DATA 054,208,005,169,048,141
906 DATA 228,003,173,228,003,157
912 DATA 230,003,202,240,007,201
918 DATA 048,208,249,076,105,003
924 DATA 162,008,160,011,173,002
930 DATA 144,010,169,000,133,251
936 DATA 042,010,133,252,133,254
942 DATA 173,005,144,074,074,074
948 DATA 005,252,133,252,169,000
954 DATA 133,253,165,254,009,148
960 DATA 133,254,173,240,003,145
966 DATA 253,189,230,003,009,128
972 DATA 145,251,138,041,001,240
978 DATA 010,136,169,058,145,251
984 DATA 173,240,003,145,253,136
990 DATA 202,208,225,076,049,234
```

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A Beginner's Guide To Typing In Programs

What Is A Program?

A computer cannot perform any task by itself. Like a car without gas, a computer has *potential*, but without a program, it isn't going anywhere. Most of the programs published in **COMPUTE!** are written in a computer language called BASIC. BASIC is easy to learn and is built into most computers (on some computers, you have to purchase an optional BASIC cartridge).

BASIC Programs

Each month, **COMPUTE!** publishes programs for many machines. To start out, type in only programs written for your machine, e.g., "TI Version" if you have a TI-99/4. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from one computer to yours.

Computers can be picky. Unlike the English language, which is full of ambiguities, BASIC usually has only one "right way" of stating something. Every letter, character, or number is significant. A common mistake is substituting a letter such as "O" for the numeral "0", a lowercase "l" for the numeral "1", or an uppercase "B" for the numeral "8". Also, you must enter all punctuation such as colons and commas just as they appear in the magazine. Spacing can be important. To be safe, type in the listings *exactly* as they appear.

Brackets And Special Characters

The exception to this typing rule is when you see the curved bracket, such as "{DOWN}". Anything within a set of brackets is a special character or characters that cannot easily be listed on a printer. When you come across such a special statement, refer to the appropriate key for your computer. For example, if you have an Atari, refer to the "Atari" section in "How to Type COMPUTE!'s Programs."

About DATA Statements

Some programs contain a section or sections of DATA statements. These lines provide information needed by the program. Some DATA statements contain actual programs (called machine language); others contain graphics codes. These lines are especially sensitive to errors.

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard, break key, and RESET (or STOP) keys may all seem "dead," and the screen may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, so always SAVE a copy of your program before you RUN it. If your computer crashes, you can LOAD the program and look for your mistake.

Sometimes a mistyped DATA statement will cause an error message when the program is RUN. The error message may refer to the program line that READs the data. *The error is still in the DATA statements, though.*

Get To Know Your Machine

You should familiarize yourself with your computer before attempting to type in a program. Learn the statements you use to store and retrieve programs from tape or disk. You'll want to save a copy of your program, so that you won't have to type it in every time you want to use it. Learn to use your machine's editing functions. How do you change a line if you made a mistake? You can always retype the line, but you at least need to know how to backspace. Do you know how to enter inverse video, lowercase, and control characters? It's all explained in your computer's manuals.

A Quick Review

1) Type in the program a line at a time, in order. Press RETURN or ENTER at the end of each line. Use backspace or the back arrow to correct mistakes.

2) Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.

3) Make sure you've entered statements in brackets as the appropriate control key (see "How To Type COMPUTE!'s Programs" elsewhere in the magazine.)

We regret that we are no longer able to respond to individual inquiries about programs, products, or services appearing in **COMPUTE!** *due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear on the CAPUTE! page, usually within eight weeks. If you have specific questions about items or programs which you've seen in* **COMPUTE!**, *please send them to Readers Feedback, P.O. Box 5406, Greensboro, NC 27403.* ©

How To Type COMPUTE!'s Programs

Many of the programs which are listed in **COMPUTE!** contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to tell exactly what to type when entering one of these programs into your computer, we have established the following listing conventions. There is a separate key for each computer. Refer to the appropriate tables when you come across an unusual symbol in a program listing. If you are unsure how to actually enter a control character, consult your computer's manuals.

Atari 400/800

Characters in inverse video will appear like: INVERSE VIDEO
Enter these characters with the Atari logo key, {*}.

When you see	Type	See	
{CLEAR}	ESC SHIFT <		Clear Screen
{UP}	ESC CTRL -		Cursor Up
{DOWN}	ESC CTRL =		Cursor Down
{LEFT}	ESC CTRL +		Cursor Left
{RIGHT}	ESC CTRL *		Cursor Right
{BACK S}	ESC DELETE		Backspace
{DELETE}	ESC CTRL DELETE		Delete character
{INSERT}	ESC CTRL INSERT		Insert character
{DEL LINE}	ESC SHIFT DELETE		Delete line
{INS LINE}	ESC SHIFT INSERT		Insert line
{TAB}	ESC TAB		TAB key
{CLR TAB}	ESC CTRL TAB		Clear tab
{SET TAB}	ESC SHIFT TAB		Set tab stop
{BELL}	ESC CTRL 2		Ring buzzer
{ESC}	ESC ESC		ESCape key

Graphics characters, such as CTRL-T, the ball character ● will appear as the "normal" letter enclosed in braces, e.g. {T}.

A series of identical control characters, such as 10 spaces, three cursor-lefts, or 20 CTRL-R's, will appear as {10 SPACES}, {3 LEFT}, {20 R}, etc. If the character in braces is in inverse video, that character or characters should be entered with the Atari logo key. For example, {■} means to enter a reverse-field heart with CTRL-comma, {5■} means to enter five inverse-video CTRL-U's.

Commodore PET/CBM/VIC/64

Generally, any PET/CBM/VIC/64 program listings will contain words within braces which spell out any special characters: {DOWN} would mean to press the cursor down key. {5 SPACES} would mean to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listings. For example, S would mean to type the S key while holding the shift key. If you find an underlined key enclosed in braces (e.g., {10 N}), you should type the key as many times as indicated (in our example, you would enter ten shifted N's). Some graphics characters are inaccessible from the keyboard on CBM Business models (32N, 8032).

For the VIC and 64, if a key is enclosed in special brackets, [< >], you should hold down the *Commodore key* while pressing the key inside the special brackets. (The Commodore key is the key in the lower left corner of the keyboard.) Again, if the key is preceded by a number, you should press the key as many times as indicated.

Rarely, you'll see in a Commodore 64 program a solitary letter of the alphabet enclosed in braces. These characters can be entered by holding down the CTRL key while typing the letter in the braces. For example, {A} would indicate that you should press CTRL-A.

About the *quote mode*: you know that you can move the cursor around the screen with the CRSR keys. Sometimes a programmer will want to move the cursor under program control. That's why you see all the {LEFT}'s, {HOME}'s, and {BLU}'s in our programs. The only way the computer can tell the difference between direct and programmed cursor control is the quote mode.

Once you press the quote (the double quote, SHIFT-2), you are in the quote mode. If you type something and then try to change it by moving the cursor left, you'll only get a bunch of reverse-video lines. These are the symbols for cursor left. The only editing key that isn't programmable is the DEL key; you can still use DEL to back up and edit the line. Once you type another quote, you are out of quote mode.

You also go into quote mode when you INSerT spaces into a line. In any case, the easiest way to get out of quote mode is to just press RETURN. You'll then be out of quote mode and you can cursor up to the mistyped line and fix it.

Use the following tables when entering special characters:

When You Read:	Press:		See:
{CLEAR}	SHIFT	CLR/HOME	
{HOME}		CLR/HOME	
{UP}	SHIFT	CRSR ↓	
{DOWN}		CRSR ↓	
{LEFT}	SHIFT	CRSR →	
{RIGHT}		CRSR →	
{RVS}	CTRL	9	
{OFF}	CTRL	0	
{BLK}	CTRL	1	
{WHT}	CTRL	2	
{RED}	CTRL	3	
{CYN}	CTRL	4	
{PUR}	CTRL	5	

When You Read:	Press:		See:
{GRN}	CTRL	6	
{BLU}	CTRL	7	
{YEL}	CTRL	8	
{F1}	f1		
{F2}	f2		
{F3}	f3		
{F4}	f4		
{F5}	f5		
{F6}	f6		
{F7}	f7		
{F8}	f8		
←	←		
↑	SHIFT	↑	

All Commodore Machines

Clear Screen	{CLR}	Cursor Left	{LEFT}
Home Cursor	{HOME}	Insert Character	{INST}
Cursor Up	{UP}	Delete Character	{DEL}
Cursor Down	{DOWN}	Reverse Field On	{RVS}
Cursor Right	{RIGHT}	Reverse Field Off	{OFF}

Apple II / Apple II Plus

All programs are in Applesoft BASIC, unless otherwise stated. Control characters are printed as the "normal" character enclosed in brackets, such as {D} for CTRL-D. Hold down CTRL while pressing the control key. You will not see the special character on the screen.

Texas Instruments 99/4

The only special characters used are in PRINT statements to indicate where two or more spaces should be left between words. For example, ENERGY {10 SPACES} MANAGEMENT means that ten spaces should be left between the words ENERGY and MANAGEMENT. Do not type in the braces or the words 10 SPACES. Enter all programs with the ALPHA LOCK on (in the down position). Release the ALPHA LOCK to enter lowercase text.

CAPUTE!

Modifications Or Corrections To Previous Articles

64 Blockhead

The program we use to generate listings caused several typographical errors in the 64 version of this game (August 1983, p. 106). The corrections are as follows:

```
770 PRINT"{HOME}{3 DOWN}{7 RIGHT}{BLK}OOP
    S!":SC=SC-5:FORT=1TO100:NEXT:PRINT"
    {HOME}{7 RIGHT}{3 DOWN}{5 SPACES}"
820 PRINT"{HOME}{15 RIGHT}{BLK}SCORE";"
    {5 SPACES}";
830 PRINT"{HOME}{15 RIGHT}{BLK}SCORE";SC
```

Atari Blockhead

Readers who have had difficulty typing in the characters in line 51 of Program 1 (p. 102) may prefer to substitute the following lines, which build B$ from DATA statements:

```
51 RESTORE 53
52 FOR I=1 TO 36:READ C:B$(I,I)=CHR$
   (C):NEXT I
53 DATA 104,165,89,133,215
54 DATA 165,88,133,214,169,0
55 DATA 133,212,133,213,162,0
56 DATA 160,0,177,214,201,84
57 DATA 208,1,232,200,152,201
58 DATA 0,208,243,138,133,212,96
```

VIC Mystery Spell

The VIC version (Program 3) of this educational game (September 1983, p. 126) allows you to enter your own word practice lists but resets to the original list after the first word. To allow additional words from your own lists, Raymond Neiford suggests adding the following lines:

```
102 COUNT=0:WR=0
103 GOSUB 1120
5012 IF M$="Y" THEN 102
```

Sprite Editor For TI

Reader Jim Van Scyoc suggests the following changes to correct minor flaws in the sprite editor utility (September 1983, p. 258) and make it easier to use:

```
110 DIM B(16,16):: SC=8
265 KCHAR=100
1005 CALL SCREEN(8)
```

Coupon File For Atari And TI

For the BASIC discount coupon filing program from the October 1983 issue (p. 52) to work properly on the Atari, the following additional line is required:

```
505 DIM K$(1),A$(3),B$(20),C$(20),D$(10),
    E$(20)
```

The program as presented will work on the TI-99 only in Extended BASIC. In console BASIC, THEN can be followed only by a line number. Changing the IF-THEN GOTO statements involves only removing the GOTO command, but replacing the IF-THEN GOSUB lines requires replacing the RETURNs with appropriate GOTOs.

64 Spiralizer

The 64 version of this graphics program from the October 1983 issue (Program 6, p. 196) contains a number of errors. The B's in line 30 should be replaced with SHIFTed B's. The A$ in line 145 should be replaced with X$. In line 203, change SYS 50012 to SYS 50039. In line 205, change SYS 50120 to SYS 50147. Thanks to Bill Crouch of the Central Florida Commodore Users Group for pointing this out.

Mosaic Puzzle

Users of all versions of this game from the October 1983 issue (p. 90) should be aware that not all goal patterns can be reached from a given starting pattern. In particular, if you reach a point where you need only switch the position of two tiles to match the goal and those two remaining tiles are side by side, then the goal pattern cannot be reached.

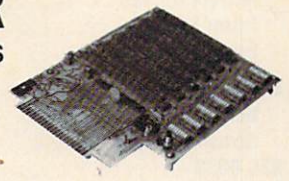
Program 2 from October, which should have been the 64 version, was actually a repeat of the VIC version. See the article "64 Mosaic Puzzle" in this issue for the correct Commodore 64 program.

64 Character Creator

This program (October 1983, p. 312) fails to fill color memory. This causes no problems on older 64s, but will render the character design grid drawn in the lower right of the screen invisible on newer models. Reader Patrick Malloy suggests the following corrections and addition to provide a simple fix:

```
29 IFL>0ORF=1THEN38
38 POKE 53281,14:PRINT CHR$(147);:POKE 53
   281,6
39 PRINT SPC(20)"IN MULTI-COLOR MODE"   ©
```


MAGIC MOTHER VIC-20 SIX SLOT BUS EXPANDER



- Accepts any VIC-20 compatible cartridges
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- Operates from VIC-20 power supply, or, from optional on board power supply (not included)
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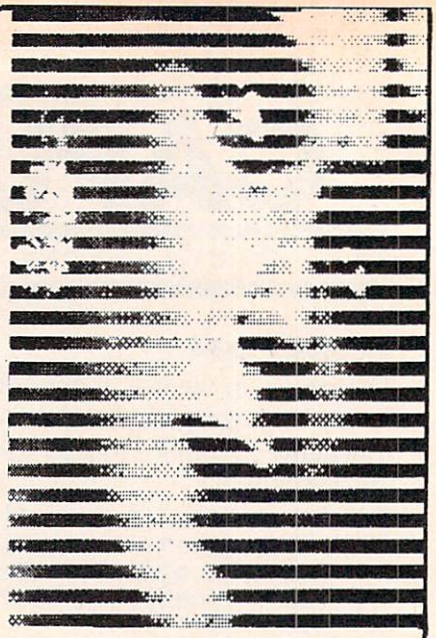

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After reading this issue of ***Compute,*** you are now fully aware of the many outstanding printers on the market today. But what you might not be aware of is that the printer you like best might not be compatible with your computer and software. (The picture above is a good example of printer incompability). At the **Printer Store,** we specialize in printers, so our experienced professional staff can help you choose the right printer for your personal and business needs. If you want the **Best Value, Low Price, Product Availability,** and **Support,** call the Printer Store and ask us about:

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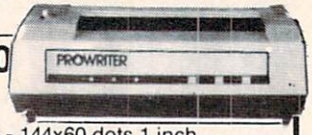

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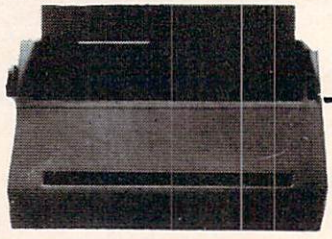

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NEWS & PRODUCTS

Buffered Programmable Printer Interface

Advanced Interface Devices has produced the Interfast-I, a 4K buffered programmable printer interface for Atari computers.

The device is compatible with the Atari 850 Interface Module printer port and requires no modification to the computer. The data transfer rate from the computer to the Interfast-I is comparable to disk transfer rates. Many program listings and text files can be dumped to the device in a few seconds, then the computer is free to work while the Interfast-I handles the printing.

The interface, which sells for $169.95, also can be programmed for advanced printing applications on printers with graphics capabilities.

Advanced Interface Devices, Inc.
P.O. Box 2188
Melbourne, FL 32902

Home Automation With A VIC

The VIC 20 Connection, a Sybex book by James W. Coffron, discusses the techniques necessary to interface a VIC-20 with home appliances.

The 260-page book examines computer input/output, analog-to-digital conversion, and other elements necessary in connecting appliances to a computer. Applications discussed in the book include a home security system, a temperature control system, and voice synthesis.

The book sells for $7.95. Add $2 for shipping and handling.

Sybex
2344 Sixth St.
Berkeley, CA 94710
(415) 848-8233

Arithmetic Tutor

Merritt Software has released *MathWiz*, a math tutorial program for Commodore computer systems.

The program provides instruction and drill in borrowing from whole numbers, finding common factors, and reducing common fractions.

Color graphics and special effects are included to keep students interested. The program, designed for students in fifth through eighth grades, provides a synopsis of each student's progress that can be applied directly to standard grading systems.

MathWiz, which includes simulated blackboard examples

The Interfast-I is a programmable printer interface for Atari computers.

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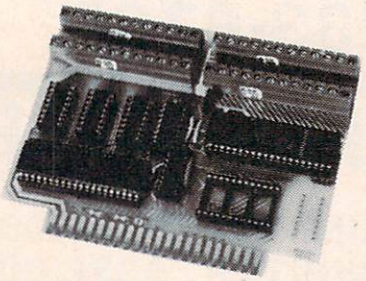

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More Power To BASIC

Amper-Magic is a program for the Apple II that allows BASIC programmers to add new commands to Applesoft without knowing machine language.

The program uses the ampersand (&) function to access machine language routines by name, without the need to know their addresses. *Amper-Magic* routines become part of your program; no separate BLOAD instructions are required.

The first volume of the program, which sells for $75, provides 23 machine language routines. Volume Two, available for $35, adds 27 more commands, including a flexible PRINT USING command.

Anthro-Digital, Inc.
P.O. Box 1385
Pittsfield, MA 01202
(413) 448-8278

Word And Number Programs For VIC, 64

Baned Software has produced a package of five programs designed to help 10- to 12-year-olds learn the parts of speech and math facts.

The programs are available for the VIC with 8K expansion or the Commodore 64 for $9.95 each, or $34.95 for the complete set.

Nouns and Verbs and *Adjectives and Adverbs* teach the parts of speech in isolation or in context. *Rocket Launch* is a game that teaches spelling and vocabulary skills. *Add Speed* enhances addition skills, and *Math Squares* involves patterns of numbers in a three-by-three matrix with one entry missing.

The programs can be played by one to four players at varying levels of difficulty.

Baned Software
113 Tenth St.
West Keansburg, NY 07734

Typing Tutor For Keyboard Novices

Sprint Typer, a typing tutor for the unexpanded VIC-20, is available from Computer Software Associates.

The program was designed for the novice typist who wants to learn touch-typing. *Sprint Typer* generates a sentence which the user types. The computer then reports typing speed and the number of errors.

The program, which is available on tape, sells for $19.95.

MicroSoftware International Inc.
50 Teed Drive
Randolph, MA 02368
(617) 961-5700

Atari Strategy Game

Devil's Dare is a skill and strategy game for Atari computers from Jay Gee Programming.

The game, played on a simulated checkerboard, involves getting five tokens in a row before the computer does. It can be played by one to four persons, each of whom must have a joystick.

Devil's Dare includes 12 board sizes and 3 skill levels. Players can choose to play against each other, or they can gang up and take on the computer as a team.

The game is available for $19.95 plus $3 for shipping and handling.

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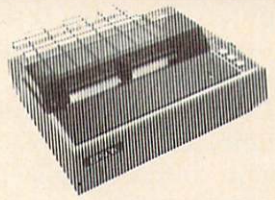

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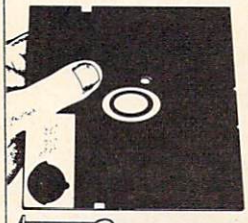

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Omnimon! can be entered at any time, and will display the program counter, registers, and stack pointer. The program has flexible disk input/output operations that are independent of DOS. It includes a complete set of debugging tools, and it allows you to dump memory off to disk or to a printer.

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Atari Renumbering Program

S M Fabac has released a *BASIC Renumbering Program* for Atari 400 and 800 computers.

The program occupies 1280 bytes of RAM and can be located anywhere at the time it is loaded.

The program is supplied on tape for $19.95, and it can be transferred to disk if available.

S M Fabac Company
910 East Fifth Terrace
Lee's Summit, MO 64063

Computer Animation Software

MovieMaker is a program that allows Apple or Atari users to create animated computer movies.

The program, which is designed to be used by the non-programmer, sells for $60.

The Atari version includes a data disk filled with preprogrammed shapes. A 16K Atari ROM cartridge version is expected to be available by year's end for $40.

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Investment Techniques For The 64

The Wizards has introduced *How to Make Good Investments*, an instructional program on investment and financial analysis.

The program, which includes a 50-page text and program cassette, is designed for the beginning or occasional investor. More advanced courses are expected to follow.

How to Make Good Investments is available for $39.95.

The Wizards
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The Woodlands, TX 77380

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Casino Roulette is a betting game from Powerline Software. The program produces a roulette board display and distributes chips as bets are placed.

Options for American or European play are available, and the game will accommodate up to five players. Each player may wager as many as 60 bets.

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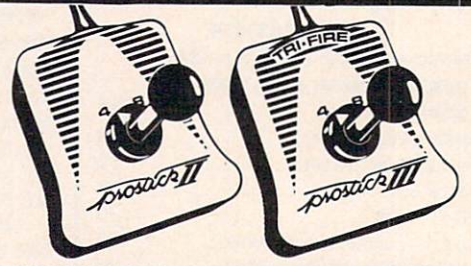

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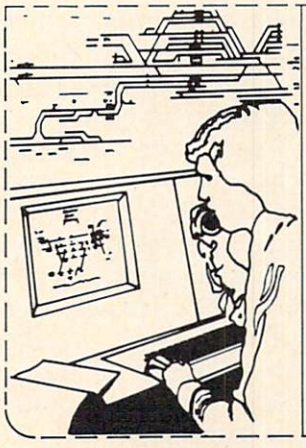

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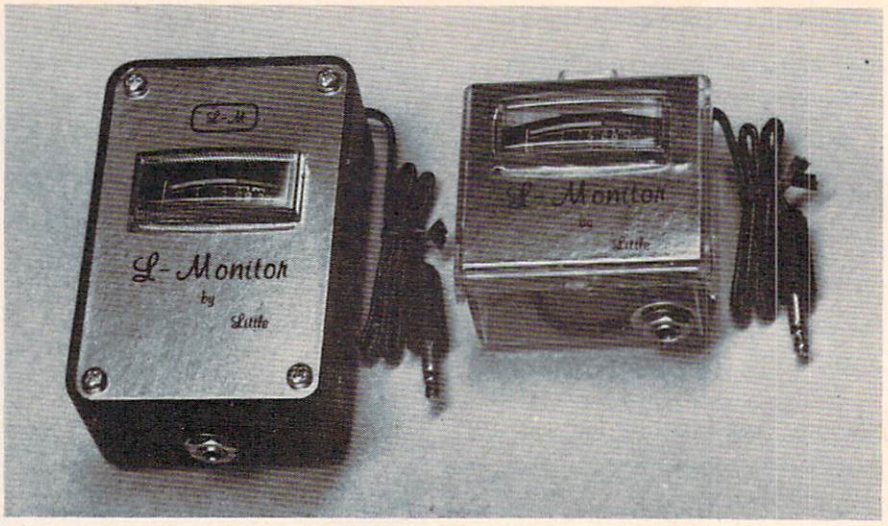

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Monitor For Apple II

Apple has produced a new monochrome monitor for the Apple II family of computers.

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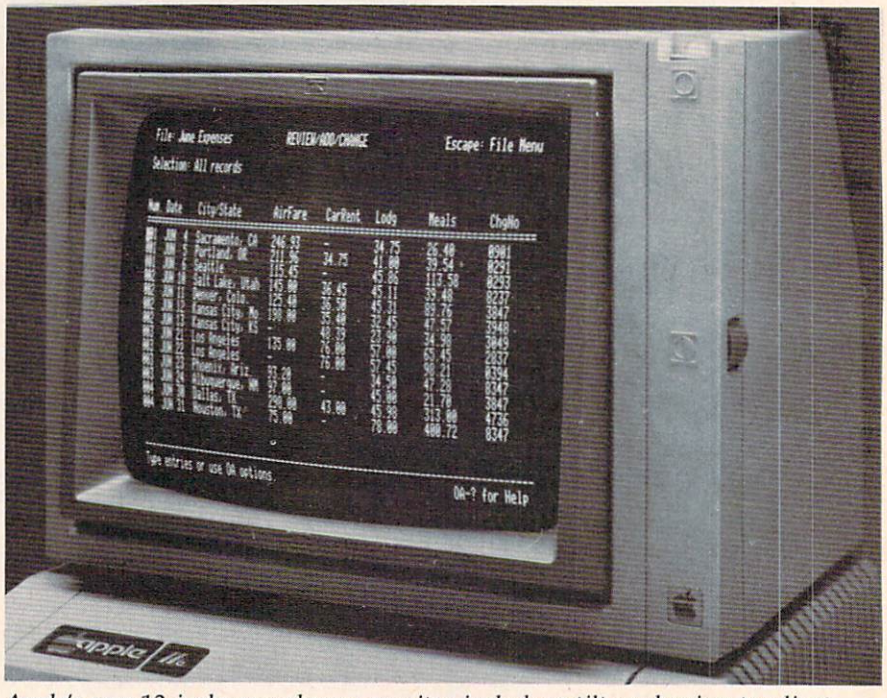
The 12-inch monitor displays 24 lines of 80 characters in high-resolution P31 green phosphor. The monitor carries a suggested retail price of $229.

Apple Computer, Inc.
10260 Bandley Drive
Cupertino, CA 95014
(408) 996-1010



Apple's new 12-inch monochrome monitor includes a tilt mechanism to adjust the angle of the screen.

Software For The Schoolhouse

Melcher Software has produced a series of programs applicable to schoolwork, in both the administrative offices and the classroom.

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Stat is designed to help teach statistics. The program includes several subprograms, including a bar graph generator, binomial frequencies, confidence intervals, comparison of means, chi-square, correlation coefficient, linear regression equation, the Central Limit Theorem, and analysis of variance. *Stat* is available for $24.95.

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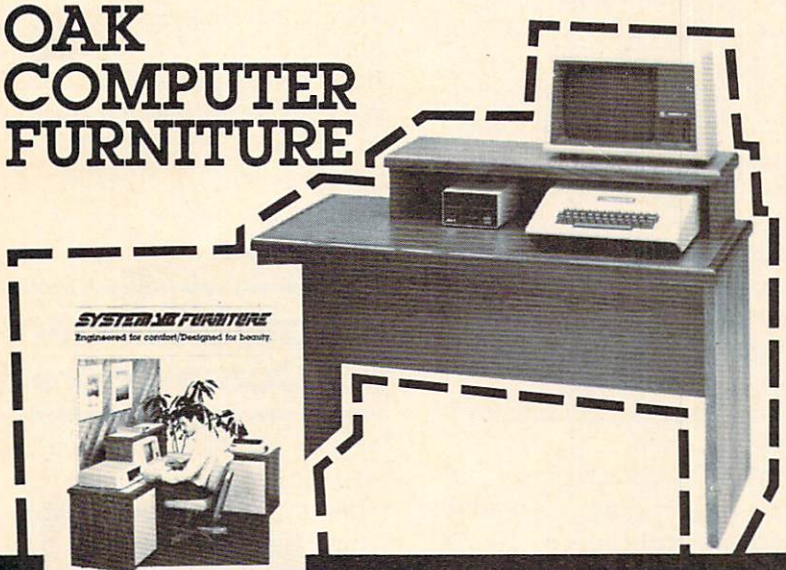

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Besides choosing a difficulty level, the player can choose any one of the four standard arithmetic operations or a combination of all. The program is available for $14.95 on tape, $19.95 on disk.

For the younger student, or even the preschooler, *Letters for Little Ones* provides a pair of educational games. Spell With Clues asks questions at random from a series of easy-to-customize questions, and Speed Letters is a game designed to develop eye coordination and letter recognition. The program sells for $9.99 on tape, $14.99 on disk.

The Attendance Master is an administrative program that can keep attendance records for up to 39 students per class and an unlimited number of classes. The program sells for $39.95. Another administrative program, *Log*, is an easy-to-use event logging aid. All events for a given date can be listed, all events pertaining to a single person can be listed, or all events can be listed. *Log*, which sells for $9.95, is available for the Apple II and Apple IIe as well as the PET and Commodore 64.

Add $2 shipping and handling for any Melcher Software program.

Melcher Software
P.O. Box 213
Midland, MI 48640

CP/M For The TI

Morning Star Software has announced production of a CP/M processor for the TI-99/4A.

The processor, which slips into the expansion box like any expansion card, comes with 64K RAM plus an 8K operating system. Suggested price for the processor is $595.

Morning Star Software
4325 109th Ave.
Beaverton, OR 97005
1-800-824-2412

Game Controller

Wico has introduced The Boss joystick, a low-priced game controller compatible with a number of computer systems.

The Boss, which sells for $19.95, is constructed of high-impact plastic, and includes a thumb-action fire button and nonskid rubber feet for table-top play.

The joystick works without modification on the Atari, Commodore 64, and VIC-20 computers. With adapters, it is compatible with the TRS-80 Color Computer, Texas Instruments, and Apple computers.

Wico Corporation
6400 W. Gross Point Road
Niles, IL 60648

Commodore 64 Mailing List

Mail Now from Cardco is a Commodore 64 mailing list program that is designed to be used with the *Write Now* word processor.

The all machine language program is menu-driven; can print single, double, or triple labels; includes an optionally printable 30-character comment line; handles up to 600 entries; and sorts by zip code, category, last name, or state. The search function includes a wildcard option.

Mail Now is available for $39.95.

Write Now, Cardco's word processing program, is available on cartridge for the VIC and 64. Its features include optional justification and text centering, multiple-line headers and footers, tape or disk storage, text scrolling, block commands, and global searches.

Write Now also allows special characters to be sent to the printer, and will number pages in either Arabic or Roman numerals. The Commodore 64 version is available for $49.95, the VIC-20 version sells for $39.95.

Cardco, Inc.
313 Mathewson Ave.
Wichita, KS 67214

Learning Games

Sierra On-Line has introduced four new learning games for the Apple, Atari, VIC-20, and Commodore 64 computers.

Learning With Leeper is designed to teach basic skills to children below reading age. Among the games provided in the program are Dog Count, in which bones are fed to hungry dogs; Balloon Pop, in which shapes are matched; and Leap Frog, in which the child helps a lost frog through a maze.

Bop-a-Bet is an action game that teaches letter recognition and alphabetization. The speed of the game increases as the child becomes more proficient.

Dragon's Keep and *Troll's Tale* are adventure games with vocabularies designed for second and third graders respectively. Both games provide practice in reading comprehension and mapping.

Sierra On-Line, Inc.
Coarsegold, CA 93614
(209) 683-6858

Karate Simulation For Commodore 64

Attack of the Phantom Karate Devils, an arcade-style martial arts simulation game, is available from Phantom Software.

The player uses a joystick to control the hero as he uses punches, flying kicks, and jumps to fend off the marauding ninjas.

The game, available for the Commodore 64, sells for $34.95.

Other Commodore 64 games forthcoming from Phantom include *Surf*, a surfing simulation, and *Particle Beam War*, a space

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Phantom Software
1116-A 8th St., Suite 155
Manhattan Beach, CA 90266
(213) 379-8686

VIC Expansion

PC Specialties has released a six-slot expander board and a memory expansion board for the VIC-20.

The VM101 expander board includes a rotary switch that can shut off the eight data lines from three of the slots, leaving auto-start game cartridges plugged in.

The board's other three slots feature an octal bus transceiver that buffers all data lines into and out of memory expansion or I/O interfaces. It also includes a reset switch to regain keyboard control when RUN/STOP-RESTORE won't.

The cost of the board is $87.

The VM201 memory expander is available in 8K, 16K, or 24K configurations. The 8K board sells for $59, and additional memory can be added for $28 per 8K block.

PC Specialties
P.O. Box 23
Fleming, PA 16835

BASIC Enhancement And Assembler For Commodore 64

Pro-Line Software has introduced *PAL 64*, a full-featured 6502 assembler which uses only 4K of memory, and *Power 64*, which adds versatility to the BASIC language.

PAL 64 source programs are typed in using the standard BASIC editor. The program includes symbol reassignment, source file chaining, conditional assembly, a recursive expression evaluator, and automatically relocatable programs. The program sells for $99.95.

Power 64 makes BASIC programming faster and easier by giving the programmer automatic line numbering and renumbering, complete trace functions, single-step functions, definition of keys as BASIC keywords, merge capability, and text search-and-replace functions.

The program, which uses 4K of memory and sells for $99.95, makes debugging easier with a WHY command and provides hexadecimal-decimal conversions.

Pro-Line Software, Ltd.
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Box 54-H
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Tax Computation is a cassette of seven programs for the VIC-20 designed to assist individual taxpayers in preparing tax returns.

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Tax Computation sells for $19.95. You must indicate your filing status when ordering.

K. R. Rullman Co.
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Programs With Everything

Sim Computer Products has introduced a series of programs called "Inside BASIC" for the VIC-20 and Commodore 64.

Described as "programs with the works," each title comes with complete documentation including a programming overview, suggested changes, line-by-line program descriptions, listings, and variable charts.

The first four titles are: *Kentucky Derby,* a horse racing and betting game; *Number Jotto,* a number guessing game; *Form Generator,* a program that allows you to set up custom forms from labels to invoices; and *Quiz Me,* in which the computer presents information, then asks questions and gives you a score.

Kentucky Derby and *Form Generator* sell for $19.95. *Quiz Me* and *Number Jotto* sell for $14.95. Add $5 for disk versions.

Forthcoming programs in the Inside BASIC Series include *Appointments, Task Organizer, Data Filer, Math Graph, Word Match,* and *Vektron.*

Sim Computer Products Inc.
1100 E. Hector St.
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(215) 825-4250

Follow The Bouncing Ball

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field while avoiding the Voids — famous for swallowing the balls.

Each time *BounceAround* is played, the initial playing board is randomly designed.

The $9.95 program requires a 3K RAM expander or a Super Expander cartridge.

Reilly Associates
P.O. Box 17144
Rochester, NY 14617

Statistical System For VIC And 64

Com-Stat is a statistical system that allows data to be entered, edited, and stored.

Once entered, the data can be analyzed by any of several statistical procedures: means or standard deviations, bivariate statistics, multiple regression, stepwise regression, scatter plots, contingency table analysis, one-way analysis of variance, or paired or unpaired t-tests.

The menu-driven system sells for $59.95.

Dr. Jerry L. Hintze
865 East 400 North
Kaysville, UT 84037
(801) 546-0445

Computer Bible Study

Bible Trip, a Smoky Mountain Software program for the Commodore 64, tests your knowledge of Bible history and geography.

Your spaceship has been caught in a time warp and you find yourself in Palestine during the first century. The computer asks you to locate Bible characters. If you know your way around Palestine, you accomplish your mission quickly.

Bible Trip is available on tape for $9.95, or on disk for $14.95.

Another program available from Smoky Mountain is *The Grade Manager*, a full-featured grade book management program for the VIC and 64.

The program can sort student files, keep track of assignments and grades, calculate averages, and provide reports to a printer or the screen.

The program is available on disk for $34.95, or on tape for $29.95. The VIC version requires 8K memory expansion.

Smoky Mountain Software
54 West Main St.
Brevard, NC 28712
(704) 883-2595

Data Base Management

Flex File 2.1 is a data base management system for the VIC and 64 by Michael Riley. It offers the same features available in earlier versions for larger Commodore machines.

A whole disk can be used for files. Records can have up to 20 fields and 254 characters. The program includes 16 menu-driven subprograms totaling about 97K.

Advanced editing features include replicate, goto, browse, snapshot, and wipe. Records may be selected by testing any field against any combination of up to 20 of any nine equality types — equals, less than, greater than, precedes, follows, etc. Wild cards also are supported.

The $110 program provides extensive user control over printed format.

Webber Software
Box 9
Southeastern, PA 19399

Check The Time

C-64 World Clock is a program which plots a high-resolution graphic map of the world and calculates world times. The program corrects for Daylight Saving Time and plots the apparent position of the sun relative to the earth.

C-64 World Clock is available for the Commodore 64 on tape for $7.95, or on disk for $10.95. Add $2 for shipping and handling.

RAK Electronics
Box 1585
Orange Park, FL 32067

VIC And 64 Games

Three games for the unexpanded VIC-20 and one for the Commodore 64 are available from Microdigital.

Gridder is an arcade-style, grid-chase game. The player controls a painter whose job is to paint squares in a maze grid. The painting task is complicated by the presence of chasers, who attempt to end the painter's work.

Pinball Wizard features one or two players in a pinball game that looks and operates like the real thing.

Skramble! is an air-strike game which requires a player to fight for survival against eight different enemy defenses.

Each of these games is programmed in machine language for the VIC-20. Tape versions are available for $19.95; disk versions cost $24.95.

Snakman, a popular VIC-20 game, is now available for the Commodore 64. The 64 version of this maze-chase game makes full use of sprite graphics and music. The machine language game gets faster and faster as the score builds. *Snakman* for the 64 is available on disk or tape for $24.95.

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Numeric Keypad For VIC And 64

Computer Place has designed a numeric keypad for the Commodore 64 and VIC-20 computers. The keypad is designed with low-profile key switches for smooth, reliable data entry. The $69.95 pad connects in parallel with the existing keyboard connector.

Also available from Computer Place is a VIC-20 expander board that includes four connector slots, a system reset switch, individual slot on/off switches, an external power supply hookup, and a fuse for overload protection. The expansion board sells for $54.95.

Computer Place
23914 Crenshaw Boulevard
Torrance, CA 90505
(213) 325-4754

The CP Numeric Keypad is available for both the VIC and 64.

Video Pinball, War Simulation

Strategic Simulations, Inc., has released a new game, *Queen of Hearts*, and a Commodore 64 version of *Knights of the Desert*.

Queen of Hearts, a video pinball game with hi-res graphics and arcade-style action, features sequential scoring like real pinball games, a variety of flippers, a "tilt," and a scoreboard that handles up to four players. It also keeps an all-time high score. Available on 48K disk for the Apple II, II+, IIe, III, and the Atari 400/800/1200 for $39.95.

A Commodore 64 version of *Knights of the Desert* is now available. Previously released for the Apple, Atari, and TRS-80, this World War II simulation recreates the North African campaign in which British troops held off the advance of Rommel's Panzer Divisions. The game is for two players or one player battling the computer (the British). Several phases per player movement are required. *Knights of the Desert* comes with rulebook, map, and disk or tape for $39.95.

Strategic Simulations, Inc.
883 Stierlin Road, Bldg. A-200
Mountain View, CA 94043
(415) 964-1353

Atari Programming Lessons

Educational Software, Inc., has added to its "Tricky Tutorial" line of programs for Atari computers.

The new programs, which sell for $19.95 to $39.95, include *Character Graphics, GTIA Graphics, Sound Effects, Memory Map Tutorial, BASIC Programming Tools,* and *Advanced Programming Tools.*

Educational Software, Inc.
4565 Cherryvale Ave.
Soquel, CA 95073

Holiday Games For TI And 64

KIDware has produced a pair of winter holiday games for young children.

Santa's Reindeer, which includes music and colorful graphics, is a concentration-type game for children ages 5 to 9. Players are asked to help Santa remember where he left his reindeer. In *Build a Snowman*, up to four players race to see who can complete a snowman first.

Both games, which are available for Commodore 64 and the TI-99/4A computers, are supplied on a single tape for $10.95. The TI version that includes speech can be ordered if a speech synthesizer and Terminal Emulator II module are available.

KIDware
Box 1664
Idaho Falls, ID 83401

Educational Games

Three new educational programs from Learning Well have been released. *Space Math*, for children in grades one through six, creates an outer space scenario in which the Zorlyns are attacking Earth. A correct answer to a variety of addition, subtraction, multiplication, and division problems lets

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the student shoot at the invaders. Available for $49.95 for the Atari 800/1200 and the Apple II/IIe.

Jungle Rescue Spelling is for elementary (grades one to four) or middle (grades five to eight) school children. A correct spelling lets the student rescue a monkey from a blazing jungle with the aid of a helicopter. The program allows either multiple choice or typing in the correct spelling. For up to six players, the game is written for the Apple II/IIe and available for $49.95.

That's My Story, a creative writing program for one or more student authors, creates the beginning of a story which students then continue. Many extra features are included. The package contains two double-sided disks for use on Apple II/IIe computers and is available for $59.95.

Learning Well
200 South Service Road
Roslyn Heights, NY 11577
(516) 621-1540

World War II Strategy For Atari

Brøderbund Software has released *Operation Whirlwind*, a military strategy game for Atari computers.

A typical game, which lasts between one and three hours, involves moving your battalion through several skirmishes. The orders at your disposal include command, movement, combat, assault order, and assault. Your victory, should you achieve it, can be designated in one of five ways: questionable, marginal, tactical, strategic, or breakthrough.

Operation Whirlwind, which includes sound effects and graphics, is designed to appeal to both novice and advanced game players. The game sells for $39.95.

Brøderbund Software
1938 4th St.
San Rafael, CA 94901

New Color Computers

Radio Shack has introduced its 64K Extended BASIC Color Computer and its 16K Color Computer 2.

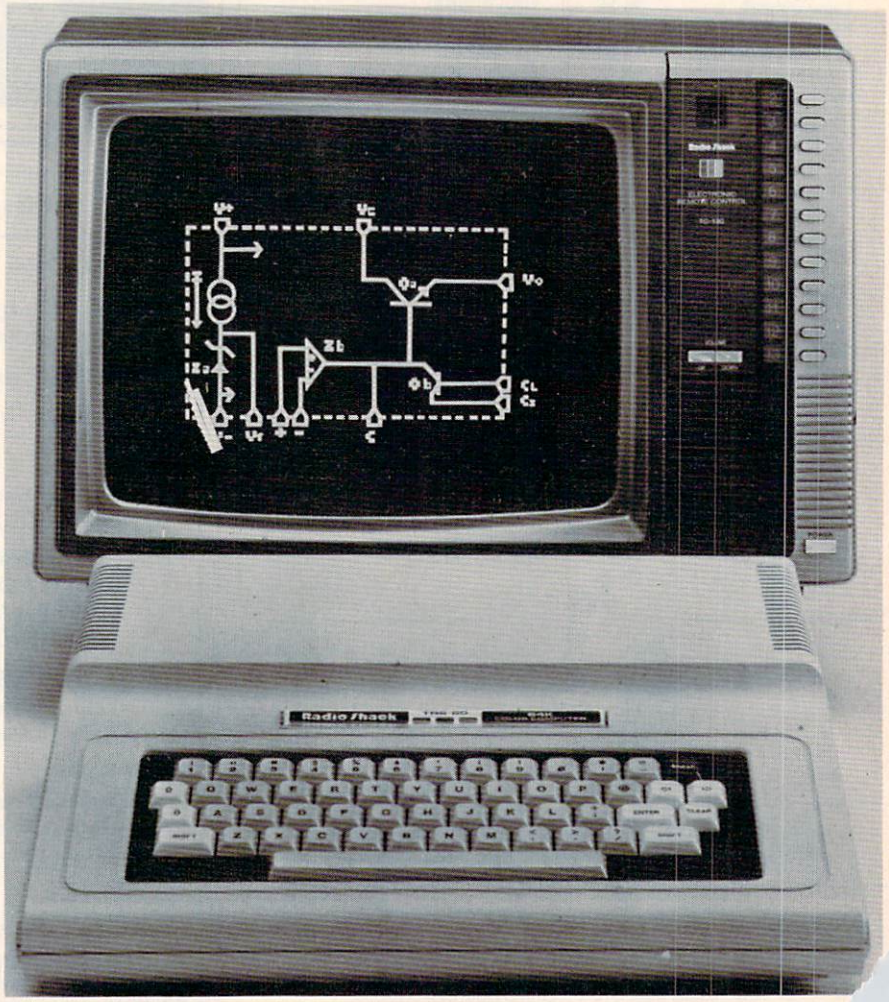
The 64K Color Computer, described as the heart of a disk-based color graphics system, sells for $399.95. Unexpanded the computer can address 32K. With the addition of the Color 2 Disk Kit ($399.95) and the OS-9 operating system ($69.95), the full 64K of memory can be used.

The 64K Color Computer comes in a white case with an electric typewriter-like keyboard. Programming features include multicharacter variable names, string arrays of up to 255 characters, trace, floating point 9-digit accuracy, trigonometric functions, user-definable keys, and PEEK, POKE, and USR commands. Up to four disk drives can be attached to the computer.

The Color Computer 2, also encased in white with a full-stroke keyboard, is available in two versions. The standard version sells for $239.95, and the extended version sells for $319.95. Both models are designed for use with a cassette recorder as a mass storage device.

The Extended Color Computer 2 offers additional programming capabilities, including PEEK, POKE, and USR commands, multicharacter variable names, and one-line commands for creation of high-resolution graphics.

Tandy Corporation/Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102



Radio Shack's 64K Color Computer comes in a white case with a redesigned keyboard.

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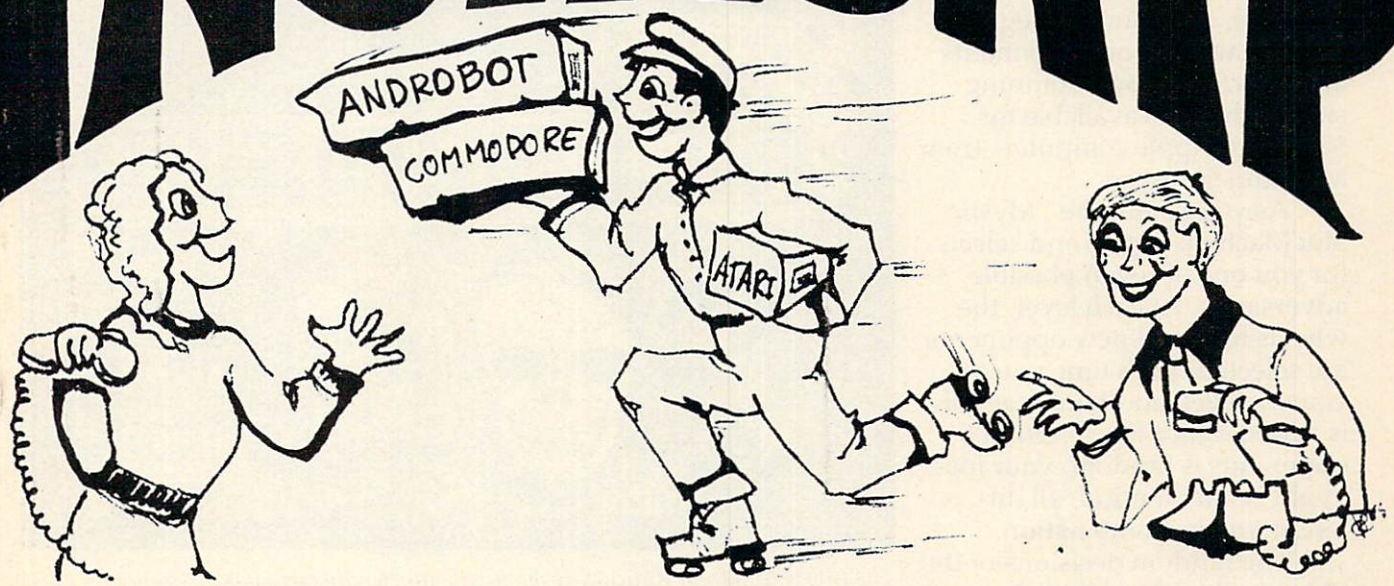

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Surviving The Slot Machine

Randamn, an action-strategy game in which your opponents are determined by a spinning slot machine, is available for $39.95 for Apple computers from Magnum Software.

As you begin, the "Mystic Slot Machine" spins and selects for you one of seven possible adversaries. At each level, the wheels turn and new opponents are selected. Each time you advance a level, another antagonist is added. Since the selection of opponents is random, your foes might be all identical, all different, or any combination.

The random decisions of the "Mystic Slot Machine" take you through seven worlds of seven levels, each including a graveyard, Stonehenge, and outer space.

Magnum Software
21115 Devonshire St., Suite 337
Chatsworth, CA 91311
(213) 700-0510

The title screen from Randamn *shows the unfriendly faces you're likely to meet if you take on the "Mystic Slot Machine."*

New Games For The Color Computer

Two new games, *Reactoid* and *Gomoku/Renju*, have been released by Radio Shack. Both are written for the TRS-80 Color Computer with at least 16K memory.

Reactoid is a futuristic action game in which the player finds himself at the world's first nuclear fusion reactor, where the automatic system has failed. With a joystick, the player must guide stray energy particles, which are slowly melting the core of the reactor, to the appropriate energy posts. All the posts must be lit up to advance to the next round.

Gomoku/Renju, based on ancient oriental strategy games, has eight levels of play. Each game (Renju is more difficult) can be played against the computer or another person.

The games sell for $19.95 each.

Tandy Corporation/Radio Shack
1800 One Tandy Center
Forth Worth, TX 76102

Timex/Sinclair Games

Four new games for 16K Timex/Sinclair computers have been produced by JPR Software. Each of the games is available on tape for $12.95.

In *Megawurm*, a machine language game, you guide a rapidly growing worm through a maze without allowing it to hit its tail. Earn bonus points by eating food left throughout the maze, but as the worm eats, its tail becomes longer.

In *The Assassin*, you have been hired to protect a terrorized king from assassins. Success depends on solving riddles during realtime play.

Orgs & Ogres is an adventure game in which you face a series of monsters while attempting to collect 1000 gold pieces or slay a dragon.

In *The Dark Empire*, a space adventure, you lead a rebellion of nobles against the tyrant Pyrinx on the planet Rion.

JPR Software, Inc.
Box 4155
Winter Park, FL 32793
(305) 646-9125

Software For Youngsters

Counterpoint Software has added three titles to its "Early Games" series, and has produced a quiz game designed for family play. The programs are: *Early Games Piece of Cake, Early Games Fraction Factory, Early Games Matchmaker*, and *Quizagon*.

In *Piece of Cake*, children learn basic arithmetic by keeping track of cakes and pastries in a magic bakery. Should a child encounter difficulty, the bakers help explain what to do.

Fraction Factory teaches elementary and junior high students to understand and work with fractions. Concepts covered

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include finding equal values, adding fractions, subtracting fractions, and multiplying whole numbers by fractions.

Matchmaker is a reading-readiness program for preschoolers. The six games included in the program involve matching colors, shapes, sizes, lines and directions, facial expressions, and reversible letters. The game is designed to be played by children two years old and up.

Each of the three above programs is available for $29.95. Disk versions are available for Apple IIe, Atari, IBM, and Commodore 64. Tape versions are available for Atari, Commodore 64, and Texas Instruments.

Quizagon is a computer quiz game for all ages. It includes more than 6,000 questions covering science, geography, sports, entertainment, history, and words. The game, which sells for $39.95, is available on disk for Apple IIe, Commodore 64, and IBM PC.

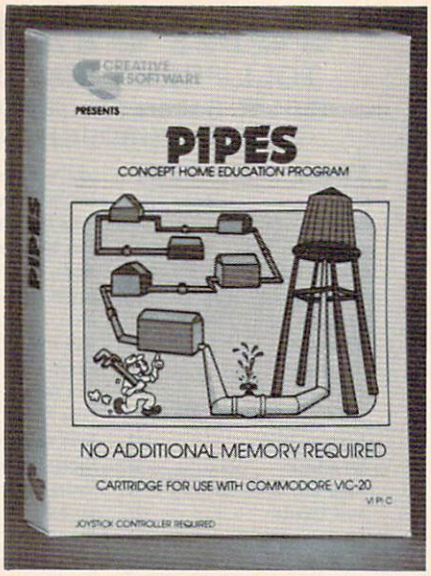
Counterpoint Software, Inc.
4005 West 65th St.
Minneapolis, MN 55435
(800)328-1223

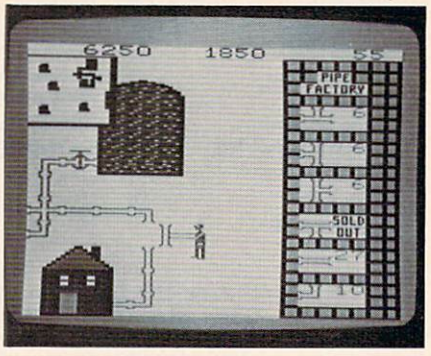
Games Converted For 64

Creative Software has converted *Astroblitz*, a space shoot-em-up, and *Pipes*, an educational program, to Commodore 64 format.

In *Astroblitz*, the player must evade spinners, saucers, seekers, and radar dishes in an effort to save the planet Nahad from destruction.

In *Pipes*, a game that teaches spatial relationships and economics, the player directs Arlo the Plumber as he selects from a bank of pipes, elbow joints, T-joints, and valves to connect the town's houses to the water supply. The object is to connect all the houses using the least amount of material—without any leaks.





Arlo the Plumber makes the final fitting in Creative Software's Pipes.

Both games are available on cartridge for $34.95.

Creative Software
230 East Caribbean Dr.
Sunnyvale, CA 94089
(408) 745-1655

Games For Atari, 64, VIC, And Color Computer

First Star Software has produced a trio of new games that play on a handful of popular microcomputers.

In *Bristles*, a game for up to four players, the assignment is to paint a building while avoiding a variety of obstacles including the building superintendent's young daughter, who enjoys putting her handprint on wet walls. While playing the 48-level game, participants can choose to be one of eight characters, each of which is programmed with its own theme music.

Flip and Flop is a three-dimensional, two-player game. The first player, a kangaroo, must turn over tiles on a multi-screened, scrolling, stepped platform maze—with a zookeeper in hot pursuit. For the second player, a monkey, the playfield turns upside down. The monkey then swings from tile to tile while trying to elude the zookeeper and reach the circus. The game includes 36 levels of play, a scrolling playfield, and six animations.

Bristles and *Flip and Flop* are available on disk, tape, or cartridge for Atari and Commodore 64 computers. Prices range from $29.95 to $39.95 depending on version.

Panic Button is a game for the VIC-20 and TRS-80 Color Computer. In the game, you work on an assembly line, building a variety of products. Things get difficult when the conveyor belts speed up and unused parts begin flying around the factory. Color Computer versions are $24.95 for tape, $39.95 for cartridge. Versions for a VIC-20 expanded to 8K are $24.95 for tape, $34.95 for cartridge.

First Star Software
22 East 41st Street
New York, NY 10017
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The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one make of computer, please state the brand name and, if applicable, the BASIC or ROM or DOS version(s) involved. In addition, *please indicate the memory requirements of programs.*

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not justify. Leave the lines ragged.

6. Standard typing paper should be used (no erasable, onionskin, or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

7. Sheets should be attached together with a paper clip. Staples should not be used.

8. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.

9. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* Please use high quality 10 or 30 minute tapes with the program recorded on both sides. The tape or disk should be labeled with the author's name, the title of the article, and, if applicable, the BASIC/ROM/DOS version(s). Atari tapes should specify whether they are to be LOADed or ENTERed. We prefer to receive Apple programs on disk rather than tape. On the other hand, tapes are preferred for the Radio Shack computer. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

It is far easier for others to type in your program if you use CHR$(X) values and TAB(X) or SPC(X) instead of cursor manipulations to format your output. For five carriage returns, FOR I = 1 TO 5:PRINT:NEXT is far more "portable" to other computers with other BASICs and also easier to type in. And, instead of a dozen right-cursor symbols, why not simply use PRINT SPC(12)? A quick check through your program – making these substitutions – would be greatly appreciated by your editors and by your readers.

10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. Articles can be of any length – from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

13. If you want to include photographs, they should be either 5x7, black and white glossies or color slides.

14. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.

15. COMPUTE! pays between $50 and $600 for published articles. In general, the rate reflects the length of the article. Payment is made upon acceptance of an article. Following submission (Editorial Department, **COMPUTE!** Magazine, P.O. Box 5406, Greensboro, NC 27403) it will take from four to eight weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. *Rejected manuscripts are returned to authors who enclose an SASE.*

16. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing "Revision" on the envelope and the article.

17. COMPUTE! does not accept unsolicited product reviews. If you are interested in serving on our panel of reviewers, contact the Review Coordinator for details.

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Home and Educational COMPUTING! (Fall 1981 and Summer 1981 — count as one back issue): Exploring The Rainbow Machine, VIC As Super Calculator, Custom Characters On The VIC, Alternative Screens, Automatic VIC Line Numbers, Using The Joystick (Spacewar Game), Fast VIC Tape Locater, Window, VIC Memory Map.

May 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032, A Fast Visible Memory Dump, Cassette Filing System, Getting To A Machine Language Program, Epidemic Simulation.

June 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever Expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, Quadra PET: Multitasking?, Mapping Unknown Machine Language, RAM/ROM Memory, Keeping TABs on a Printer.

July 1981: Home Heating and Cooling, Animating Integer BASIC Lores Graphics, The Apple Hires Shape Writer, Adding a Voice Track to Atari Programs, Machine Language Atari Joystick Driver, Four Screen Utilities for the PET, Saving Machine Language Programs on PET Tape Headers, Commodore ROM Systems, Using TAB, SPC, And LEN.

August 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying, Adding A Programmable Sound Generator, Converting PET BASIC Programs To ASCII Files.

October 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, and VIC; Budgeting on the Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train Your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

December 1981: Saving Fuel $$ (multiple computers), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Atari Word Processor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game, Replacing The INPUT# Command, Foreign Language Text on The Commodore Printer, File Recovery.

January 1982: Invest (multiple computers), Developing a Business Algorithm (multiple computers), Apple Addresses, Lowercase with Unmodified Apple, Cryptrogram Game for Atari, Superfont: Design Special Character Sets on Atari, PET Repairs for the Amateur, Micromon for PET, Self-modifying Programs in PET BASIC, Tinymon: a VIC Monitor, VIC Color Tips, VIC Memory Map, ZAP: A VIC Game.

May 1982: VIC Meteor Maze Game, Atari Disk Drive Speed Check, Modifying Apple's Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artifacting, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

August 1982: The New Wave Of Personal Computers, Household Budget Manager (multiple computers), Word Games (multiple computers), Color Computer Home Energy Monitor, A VIC Light Pen For Under $10, Guess That Animal (multiple computers), PET/CBM Inner BASIC, VIC Communications, Keyprint Compendium, Animation With Atari, VIC Curiosities, Atari Substring Search, PET and VIC Electric Eraser.

September 1982: Apple and Atari and the Sounds of TRON, Commodore Automatic Disk Boot, VIC Joysticks, Three Atari GTIA Articles, Commodore Disk Fixes, The Apple Pilot Language, Sprites and Sound on the Commodore 64, Peripheral Vision Exerciser (multiple computers), Banish INPUT Statements (multiple computers),

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January 1983: Sound Synthesis And The Personal Computer, Juggler And Thunderbird Games (multiple computers), Music And Sound Programs (multiple computers), Writing Transportable BASIC, Home Energy Calculator (multiple computers), All About Commodore WAIT, Supermon 64, Perfect Commodore INPUTs, VIC Sound Generator, Copy VIC Disk Files, Commodore 64 Architecture.

March 1983: An Introduction To Data Storage (multiple computers), Mass Memory Now And In The Future, Games: Closeout, Boggler, Fighter Aces, Letter And Number Play (all for multiple computers), VIC Music, Direct Atari Disk Access, Automatic Commodore Program Selector, PET Quickplot, A Commodore Gotcha, VIC and Atari Memory Management, Friendly VIC INPUTs.

April 1983: Selecting The Right Word Processor, Air Defense (multiple computers), Commodore Structure BASIC, Retirement Planner (multiple computers), Dr. Video For Commodore, Atari Filefixer, Video 80:80 Columns For The Atari, VICword, Magic Commodore BASIC, A BASIC Hex Editor For VIC, VIC Music Theory.

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July 1983: Constructing The Ideal Computer Game, Techniques For Writing Your Own Adventure Game, SpeedSki And Time Bomb (VIC), Castle Quest And Roadblock (Atari), RATS! And Goblin (64), How To Create A Data Filing System (multiple computers), How To Back Up Disks For VIC And 64, Atari Artifacting, All About The Commodore USR Command, TI Mailing List.

August 1983: Weather Forecaster (multiple computers), First Math And Clues (multiple computers), Converting VIC And 64 Programs To PET, Atari Verify, Apple Bytechanger, VIC And 64 Escape Key, Banish Atari INPUT Statements, Mixing Graphics Modes On The 64, VICplot, VIC/64 Translations: Reading The Keyboard, Musical Atari Keyboard, VIC Display Messages.

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AUGUST 1983: Your First Hour With A Computer, Should You Join A Users Group, Guide To Commodore Users Groups, The Viper, Cylon Zap, product reviews, VIC/64 Mailing List, Word Spell, Global Scan For VIC/64, Machine Language For Beginners, VIC Title Screens, 64 Hi-Res Graphics Made Easy, VIC/64 Four-Speed Brake, Disk Menu, Using A 1540 Disk Drive With The 64, Playing Computer Music, Simple Answers To Common Questions, HOTWARE, VICreations — Caring For Disk Drives/Cassettes, 64 Explorer, News & Products.

SEPTEMBER 1983: Telecomputing Today, Telecomputing Glossary, Commodore's Nationwide Party Line, Commodore Bulletin Boards, Demon Star For VIC/64, Potholes, product reviews, Checkbook Reporter, States & Capitals Tutor For VIC/ 64, MiniTerm-20, TeleTerm 64, POKEing Graphics, Machine Language For Beginners, 64 Searcher, Better Commodore Input, Using The Function Keys, Simple Answers To Common Questions, HOTWARE, VICreations — Understanding Random Numbers.

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NOVEMBER 1983: Binary Numbers — Part 1, Getting Started With A Disk Drive — Part 1, Chicken Little, Martian Prisoner, product reviews, Munchmath, VIC Super Expander Graphics, 64 Aardvark Attack, 64 Timepiece, Connect The Dots, Custom Characters For VIC/64, Making Custom Characters On The 64, Making Custom Characters On The VIC, VIC/64 Program Lifesaver, Understanding 64 Sound — Part 2, Merging Programs On The 64, Tutorial On DATA, READ, RESTORE Statements, One-Touch Commands For The 64, VIC/64 Disk Defaulter, Machine Language For Beginners, Simple Answers To Common Questions, HOTWARE, VICreations — Animation With Custom Characters, Horizons 64 — Software And Hardware Reviews, News & Products, Automatic Proofreader.

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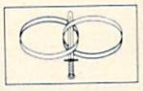

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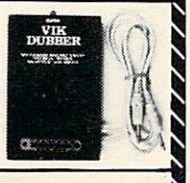

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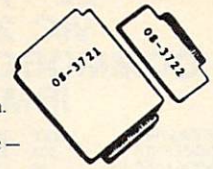

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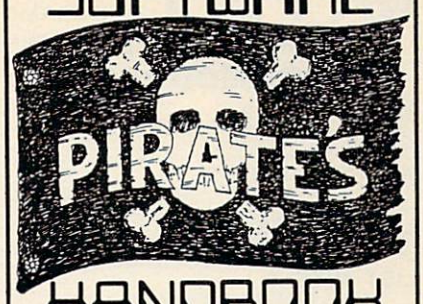

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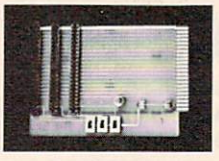

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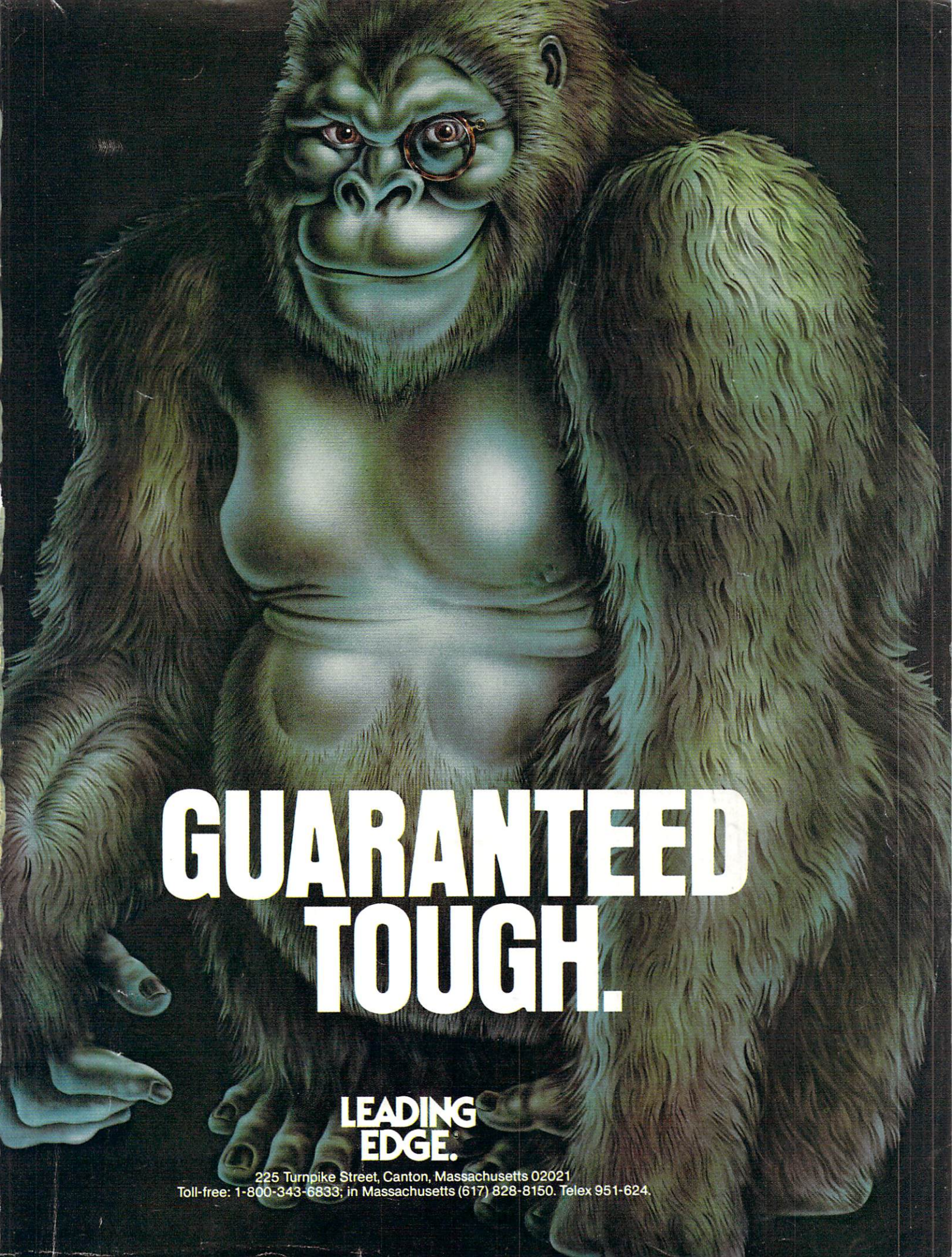
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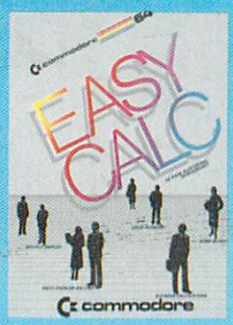

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